"America's Foremost Radiophone Review"

April
25 Cents

The WIRELESS AGE

Cunningham

Tubes for Every Requirement

Vacuum tubes are used for two distinct individual purposes in a receiving set—as DETECTORS and as AMPLIFIERS. The qualifications of a tube for these two uses are so different that for maximum efficiency tubes of entirely different design must be used.

This point was one of the chief considerations of the research engineers who designed Cunningham tubes in the great laboratories of the General Electric Company. After years of research and experimental work, the Cunningham C-300, a SUPER-SENSITIVE DETECTOR, the Cunningham C-301, a DISTORTIONLESS AMPLIFIER, and the Cunningham C-301A, a LOW FILAMENT CURRENT AMPLIFIER, were developed. These three tubes, now nationally recognized as standards for all types of receiving sets, are responsible for the highly perfected results obtainable in radio phone reception.

The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

TYPE C-300
Super-Sensitive
DETECTOR
$5.00

TYPE C-301A
¼ Amp. Fil-Current
Amplifier and Detector
$6.50

Patent Notice— Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08 and others issued and pending. Licensed for amateur, experimental and entertainment use in radio communication. Any other use will be an infringement.

E. T. Cunningham

Home Office:
248 First Street
San Francisco, Calif.

Eastern Representative:
154 West Lake St.
Chicago, Illinois

New Radio DRY CELL "A" Battery for WD-11 Tubes

The Dry Cells in this 1½ volt, 4-cell, steel case, New EVEREADY "A" BATTERY were developed especially for use with WD-11 Vacuum Tubes. Last longer than Dry Cells made for other purposes. Longer Service Hours Means Economy. Only two connections.

For the "B" or Plate Circuit use EVEREADY "B" Batteries

Also made in two other sizes: 2-cell, 1½ volt, No. 7211 and 1-cell, 1½ volt No. 7111.

FOR BETTER RESULTS USE

EVEREADY Radio Batteries

NO ACID · NO NOISE · SAFE
CLEAN · · · · ECONOMICAL

Volume 10 *Edited by* J. ANDREW WHITE *Number* 7

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Because certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signalling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

Printed in U. S. A.

"America's Foremost Radiophone Review"

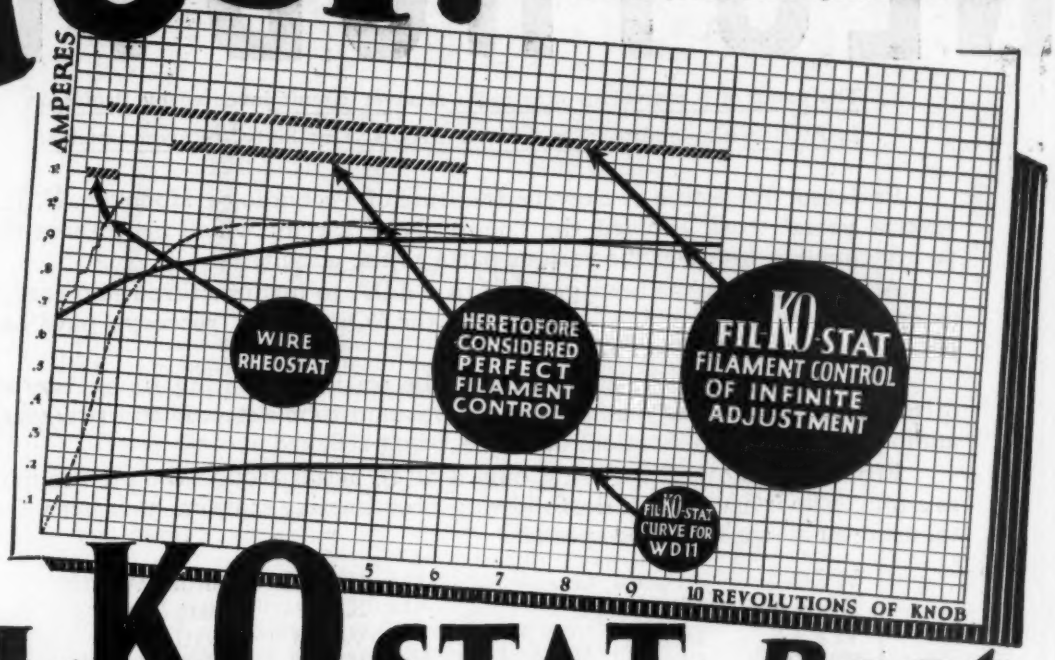
THE WIRELESS AGE is a member of the Audit Bureau of Circulations.
During the last six months of 1922 there were printed 204,650 copies of THE WIRELESS AGE
Of this issue 33,000 copies are printed.

Proof!

Graphic proof of FIL-KO-STAT superiority as shown here can be had in any laboratory equipped with Bureau of Standards Instruments.

Practical proof of FIL-KO-STAT superiority is evident the moment you put FIL-KO-STATS in place of the devices you now use to regulate filament action.

Here's the Comparison of Fine Adjustment Control Range of FIL-KO-STAT with Rheostats and Other Filament Controls Clearly Indicating How FIL-KO-STAT Excels and Showing Wherein it Permits Perfect and Gradual Current Increase With Infinite Adjustments


AMPERES
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HERETOFORE CONSIDERED PERFECT FILAMENT CONTROL
FIL-KO-STAT FILAMENT CONTROL OF INFINITE ADJUSTMENT
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The Filament control of Infinite adjustment
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CURRENT INCREASE PERFECT AND GRADUAL
LIKE THE RISING SUN
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of Electronic Flow

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indicating complete "A" Battery disconnection.

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starts where tube *begins* to function.

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No Disks to Break or Chip
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GUARANTEED
The FIL-KO-STAT is to all purposes "fool proof". Each instrument is packed with the maker's guarantee that it will be replaced if broken within one year.

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DX INSTRUMENT Co.
HARRISBURG PA.

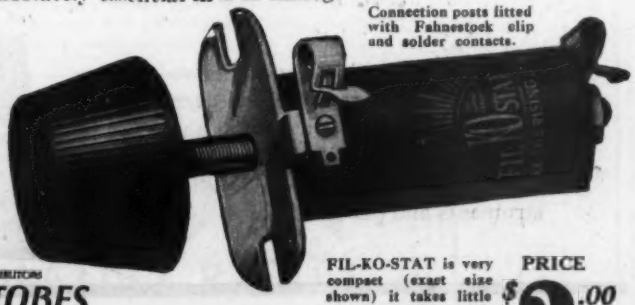
You have been eagerly waiting for just this instrument Mr. Set Builder, amateur or manufacturer. It marks a step forward in Radio. It is not an adaptation of some old method of current control. It is not a rheostat. IT IS A FILAMENT CONTROL, distinctly designed to utilize the great tuning possibilities of the vacuum tube itself.

Its superiority is proven by every test. It regulates the FILAMENT HEAT. It gives absolute control of the ELECTRONIC FLOW and consequently permits THE FINEST TUNING POSSIBLE.

Perfect and gradual increase of filament heat assures longer life to the tube. Fine adjustment of fractional currents makes it ideal for use with Dry Cell tubes.

And infinitesimal control of electronic flow gives a corresponding control of fine detection so absolutely essential in DX tuning.

The time to replace all other filament control devices with FIL-KO-STATS is *now*. Say "FIL-KO-STAT" to your dealer today. If he has none in stock send his name and your remittance direct to



Connection posts fitted with Fahnestock clip and solder contacts.

SOLE INTERNATIONAL DISTRIBUTORS
RADIO STORES CORPORATION
218-222 West 34th St.
Dept. WP NEW YORK

WIRE ORDERS FILLED TO JOBBERS AND DEALERS

FIL-KO-STAT is very compact (exact size shown) it takes little space on the panel. So mountable it can replace any other control without redrilling.

PRICE $2.00

NEUTRODYNE

The name of a marvelous new radio receiver circuit invented by Professor L. A. Hazeltine and used in the new FADA "One-Sixty" receiver amplifier.

Professor Hazeltine of Stevens Institute of Technology, Hoboken, N. J., after several years' work evolved the "neutrodyne" circuit which neutralizes the capacity coupling between the various parts of the circuit.

A broad license has been granted to FADA to manufacture radio equipment using this new "neutrodyne" circuit, and the "One-Sixty" receivers have been in production for several weeks.

The FADA "One-Sixty" is a four tube set incorporating tuner, two stages of tuned radio frequency amplification, vacuum tube detector and two stages of audio frequency amplification, one tube being reflexed.

From New York City, using only a 50 ft. aerial around the picture molding in a fourth floor apartment, the following broadcasting stations have been listened to, using in all cases, a loud speaker:

WSB	Atlanta, Ga.	WBAP	Fort Worth
KDKA	Pittsburgh	KSD	St. Louis
WFAA	Dallas	WGM	Atlanta
KYW	Chicago	KFI	Los Angeles
WDAF	Kansas City	WDAP	Chicago
WOAI	San Antonio	WHAS	Louisville
WOC	Davenport	PWX	Havana, Cuba

With the FADA "One-Sixty" receiver you will have the most modern receiver possible to design, and one that allows ultra-efficient reception of broadcasted concerts as well as long distance amateur 200 meter signals.

A four page bulletin has been published describing in detail the FADA "One-Sixty." We will be glad to send you a copy on request.

F. A. D. ANDREA
1581-C Jerome Avenue
New York City

The mechanical design and construction of the receiver has been given a great deal of attention and the workmanship is of the high grade class for which FADA instruments and parts are noted.

When every hour counts

BILL wanted to make his radio set as quickly as possible. The ABC station was broadcasting some "great" concerts every day.

But at the very beginning there was a delay in getting his panels. It wasn't a long delay, but he was impatient and wanted to make every hour count.

You, Bill, and every radio set-builder can avoid such a delay by getting Celoron Standard Radio Panels. These panels are made in seven sizes, selected to meet every requirement of the set-maker. You don't have to wait for your panel to be cut. There's no extra expense for cutting to your order. You go to your dealer and give him the size. He has a Celoron panel which you can carry home with you at once.

Thus, for the first time, as far as we know, panels are on the market ready for the consumer. Each panel comes trimmed and wrapped separately in glassine paper to protect the surface. On each one are full instructions for working and finishing.

Celoron makes an ideal panel. It is easily worked, machine drilled and tapped and will engrave evenly without feathering. After thorough tests it has proved to have all the essential characteristics for radio work. It has high surface and volume resistivity, high dielectric strength and low dielectric losses. That's the reason thinking radio enthusiasts who want the highest type panel insist upon Celoron.

Select from these sizes the one you need:

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2. — 7 x 9 x 1/8
3. — 7 x 12 x 1/8
4. — 7 x 18 x 3/16
5. — 9 x 14 x 3/16
6. — 7 x 21 x 3/16
7. — 12 x 14 x 3/16

Make every hour count in making your radio set. If your radio dealer has not yet stocked these panels, ask him to order for you. Or write direct to us. Be sure to designate by number the size you want.

Diamond State Fibre Company

BRIDGEPORT (near Philadelphia) PENNSYLVANIA

BRANCH FACTORIES AND WAREHOUSES
BOSTON CHICAGO SAN FRANCISCO
Offices in Principal Cities
In Canada: Diamond State Fibre Company of Canada, Limited
245 Carlaw Avenue, Toronto

To radio dealers : **Condensite Celoron Radio Panels in standard sizes offer an exceptional opportunity in quick sales and substantial profit. Write for special dealer price list showing standard assortments.**

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EVERYDAY RECEPTION over distances that far outstrip the commonly accepted records — this (not baseless claims) is the evidence of MU-RAD superiority. The only set that can achieve such astonishing sensitivity, using a small loop aerial. Delightfully fine selectivity. With all this efficiency and completeness, utterly simple to operate. Each set guaranteed for 1000 miles reception.

4300 MILES

on an indoor loop aerial

Four thousand, two hundred and seventy-eight miles away in Honolulu, the Royal Hawaiian Orchestra plays for delighted listeners in St. Louis, U.S.A., through their MU-RAD Receiving Set. An example of MU-RAD supremacy.

Write For Literature.

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MU-RAD LABORATORIES, INC.

808 FIFTH AVE. ASBURY PARK, NEW JERSEY

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RADIO NEWS
NO SOUND!
NO JUICE
!!
ARRRR NO CONCERT!
SAY JOE, THIS IS ED — WHERE D'YA GO GET YOUR BATT'RY RECHARGED, EH?
— WHY DO YOU DO IT? YOU HAVE ELECTRICITY IN YOUR HOME — CHARGE 'EM WITH A TUNGAR!!
TUNGAR CHARGES OVER NIGHT

Do you lug your battery to have it charged?

Do you put off lugging it down street until it runs down and fails to give good results?

How many good concerts do you miss or only half hear?

With Tungar in the house you are prepared for best results always, and without having to move the battery an inch.

Tungar—the go-between from house lighting circuit to battery, attaches wherever there is a lamp or convenience outlet. Just turn it on and leave it, any time day or night. Its cost of operation is low. It makes convenient the necessary charging that prolongs battery life.

Tungar has no moving parts to cause trouble. It is *certain, clean, quiet.*

Good for the auto battery too, the same Tungar.

See it at any good electrical shop, or write for literature.

Address Section WA4.

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General Electric Company
Bridgeport, Connecticut.

Tungar Battery Charger
Operates on Alternating Current
2 Ampere Outfits complete, $18.00
5 Ampere Outfits complete, $28.00
(Prices east of the Rockies)
Special attachment for charging 12 or 24 cell "B" Storage Battery—$3.00 —fits either size Tungar.

Charge 'em at Home, with

Tungar

BATTERY CHARGER

A GENERAL ELECTRIC PRODUCT

35A-94

Brandes

ARE you getting long distance radio stations—are you catching clear and distinct the faintest signals that mark the extreme range of a good receiving set? A Brandes *Matched Tone* Radio Headset will make the faint signals understandable. The two receivers are perfect sound-mates—they are matched in tone to improve the clearness of the message. Brandes *Matched Tone* Headsets are guaranteed to get the best results obtainable from any set.

¶ Send ten cents in stamps for the "Beginner's Book of Radio." It explains radio in terms that anyone can understand.

Distributors in Australia and New Zealand: International Electric Co., Wellington, N. Z.

Made in Canada and England by Canadian Brandes Limited, Toronto and London
Distributed in Canada by Perkins Electric Limited, Toronto, Montreal, Winnipeg

C. Brandes, INC. - 237 Lafayette St., N.Y.C.

Matched Tone

TRADE MARK REG. U.S. PAT. OFF.

Radio Headsets

Magnavox *prices* are the result of Magnavox *quality*

IN the long run, the price of the really successful and satisfactory product is set by the *purchaser*—not by the *maker* or the *dealer*.

Because when the manufacturer and dealer charge too much for a product, they destroy its market; and when they charge too little they destroy its quality—which results in the same thing—loss of market.

Magnavox Radio products are of the highest quality—and their prices bring them within reach of every serious radio user.

R2-18 Magnavox Radio
(With 18-inch horn)

This instrument is intended for those who wish the utmost in amplifying power; for clubs, hotels, dance halls, large audiences, etc. It requires only .6 of an ampere for the field.
Price $60.00

R3-14 Magnavox Radio
(With 14-inch horn)
As illustrated

The ideal instrument for use in homes, offices, amateur stations, etc. Same in principle and construction as Type R-2.
Price $35.00

AC Magnavox Power Amplifier
As illustrated

For use with the Magnavox Radio and insures getting the largest possible power input.

2-stage, $55.00
3-stage, $75.00

Magnavox Radio, can be used with any receiving set of good quality. Ask your dealer to demonstrate it *with* the Magnavox Power Amplifier, as illustrated. This combination produces the most satisfactory results.

What matters bad weather when Radio entertains?

RADIO'S "every-hour-every-where" broadcast schedule is the most stupendous organization of the means of entertainment the world has ever witnessed.

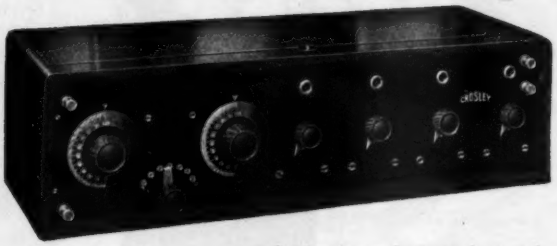
So responsive have people been to the opportunity of enjoying these programs at their best that Magnavox equipment has become synonymous with the full enjoyment of radio music and speech for an ever-greater circle of satisfied users.

Magnavox Products can be had from good dealers everywhere. Our interesting new booklet will be sent on request.

The Magnavox Co., Oakland, California
New York: 370 Seventh Avenue

MAGNAVOX Radio
The Reproducer Supreme

CROSLEY Model X $55
A 4 Tube Radio Frequency Set



The hit of the radio world. Not until you have listened in on a Crosley Model X can you appreciate the wonders of radio. Every day letters are received from satisfied customers telling of far distant stations clearly and distinctly heard.

The Crosley Model X offers you by far the greatest value on the radio market today. It is a four tube set, consisting of one stage of tuned radio frequency, detector and two stages of audio frequency amplification. It is very easy to tune, and eliminates static and local interference to a remarkable degree. Because of its simplicity, any one may quickly tune in the desired broadcasting station to maximum volume.

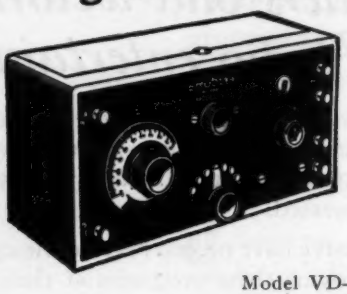
Listen In On A Crosley Model X And You Will Have No Other.

For Sale By Good Dealers Everywhere.

CROSLEY MANUFACTURING COMPANY
428 ALFRED ST. CINCINNATI, OHIO

CROSLEY Model VD $19
Regenerative Receiver Set

(Licensed under Armstrong U. S. Patent 1113149)



There is no other one-tube set being manufactured today that will give better results than produced by the Crosley Model VD Regenerative Radio Receiver. The proud owner of one of these instruments can bring in any powerful station in the United States. Stations more than 1,000 miles away are being copied regularly on this set. Equal in every respect to the guaranteed performance of this instrument are its finish and appearance. It is made in two models as follows:

	Tuner Detector	2 Stage Amplifier
Model VD—With overhanging lid, panel engraved, without tubes, batteries or phones. Price	$19	$17
Model VC—With regular new style Adam Brown mahogany cabinet, panel engraved, Price	$20	$18

Compare these prices with anything on the market.

The cabinets of both models are arranged so that the now popular 1½-volt tubes may be used if desired. The trade name "Crosley" is used by permission of the Crosley Manufacturing Company.

For Sale by Good Dealers Everywhere.

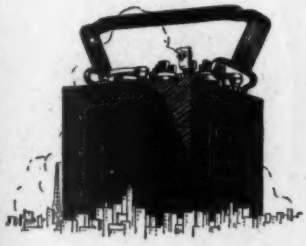
Write for Complete Catalog.

THE PRECISION EQUIPMENT COMPANY
POWEL CROSLEY, JR., President
428 GILBERT AVE., CINCINNATI, OHIO

How much do you expect your battery to do?

TURNING the dials with a battery that is a constant offender is not much fun. You cannot thoroughly enjoy radio broadcastings unless your battery is up to the job.

Exide Radio Batteries are conservatively rated and give full ampere-hour capacity. They maintain steady voltage and deliver uniform filament current to the tubes. From plates to connector terminals each detail is the result of experience gained in every field of battery service by the oldest and largest makers of storage batteries in the world.



Exide Batteries play a leading role in the industrial world. They propel trucks, mine locomotives, and submerged submarines; they operate the fire alarm system and send your voice over the telephone. Most of the government and commercial wireless stations are equipped with Exide Batteries.

Your radio dealer will show you an Exide Radio Battery, or you can get one at any Exide Service Station.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia, Pa.

Service Stations Everywhere
Branches in Seventeen Cities

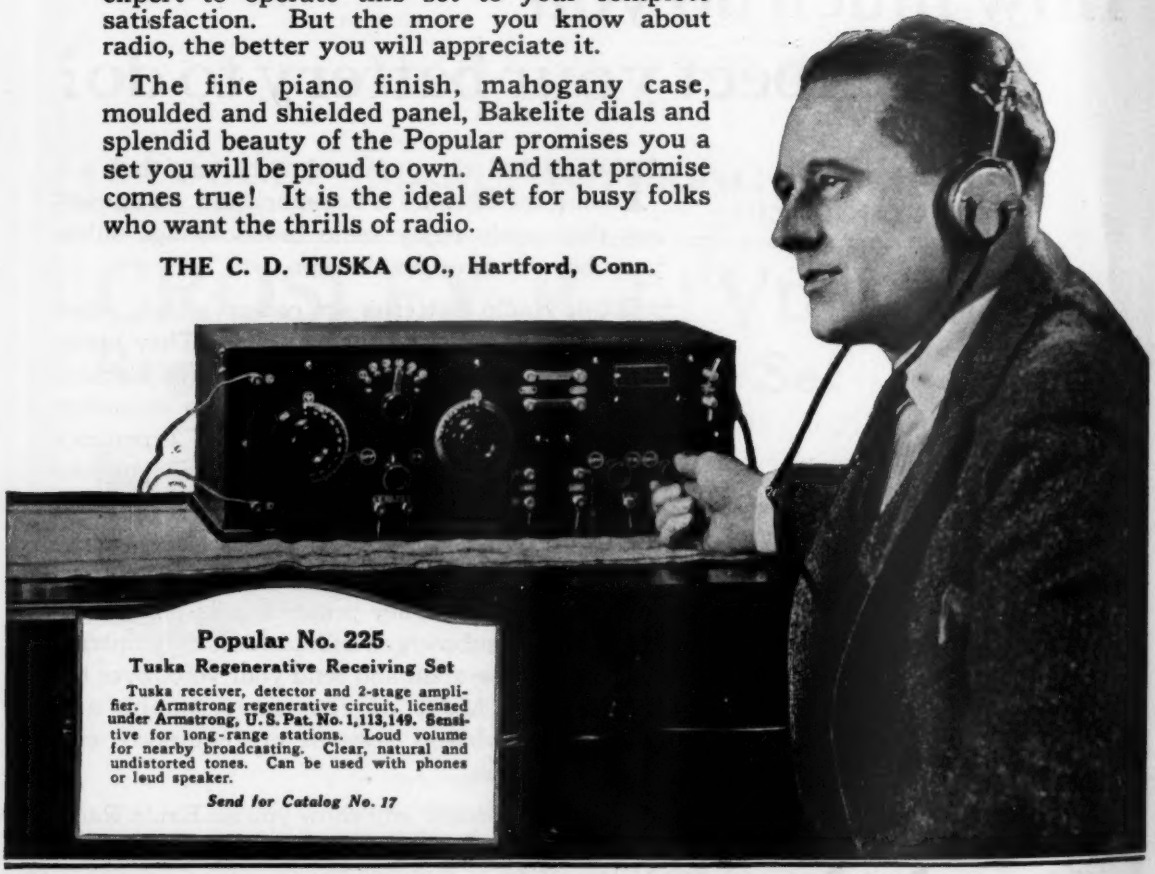
Popular! -for good reasons

RADIO enthusiasts wanted an expertly designed, moderate-priced set that any intelligent man or woman could operate. So we built the Popular, to sell at a popular price.

Just two dials to turn to find the stations broadcasting within a range of 500 miles. As you become more experienced you can reach out twice as far. You don't have to become an expert to operate this set to your complete satisfaction. But the more you know about radio, the better you will appreciate it.

The fine piano finish, mahogany case, moulded and shielded panel, Bakelite dials and splendid beauty of the Popular promises you a set you will be proud to own. And that promise comes true! It is the ideal set for busy folks who want the thrills of radio.

THE C. D. TUSKA CO., Hartford, Conn.



Popular No. 225

Tuska Regenerative Receiving Set

Tuska receiver, detector and 2-stage amplifier. Armstrong regenerative circuit, licensed under Armstrong, U. S. Pat. No. 1,113,149. Sensitive for long-range stations. Loud volume for nearby broadcasting. Clear, natural and undistorted tones. Can be used with phones or loud speaker.

Send for Catalog No. 17

TUSKA RADIO

TUSKA TRADE MARK RADIO

ONE STEP FURTHER

Ship Radio Operators gather much experience at sea. They are often given the opportunity of graduating into better positions.—N. Y. Mail Radio Review.

Almost all of the officials of the world's largest radio manufacturing and commercial radio company—its superintendents, district managers, foremen and traveling representatives are former wireless operators—nearly all of them graduates of the Radio Institute of America.

The practical experience gained at sea is invaluable and affords knowledge that cannot be gained elsewhere.

A government commercial radio operator's license certificate paves the way for a successful future, but although you may possess such a license you are not assured of a position. Wireless companies want trained men—young men who have been efficiently trained and who, in addition to possessing the necessary qualifications to secure a license, can be relied upon to render real radio service—that is the kind of training you get in the Radio Institute of America.

The eastern division of the Radio Corporation of America accepts no inexperienced wireless operators in its service other than the graduates of the Radio Institute of America—again it is the training that counts.

Investigate the advantages offered through taking our instruction. Our class rooms and laboratory contain a more complete equipment of radio apparatus than any wireless school in the United States and our instruction is the most sound and thorough.

For the benefit of those who cannot attend our resident schools we maintain a **HOME STUDY COURSE** covering the entire radio theory from magnetism and elementary electricity through to commercial apparatus of the latest design. Code is taught by means of specially constructed transmitters.

Our instruction covers the entire radio field—our graduates cover the world.

Detach that coupon and send it today.

Radio Institute of America

(Formerly Marconi Institute)

ESTABLISHED 1909

America's Oldest and Foremost Radio School

326 Broadway, New York, N. Y.

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331 Call Building, New Montgomery Street
San Francisco, Cal.

Please indicate whether Home Study or Resident School is desired

RADIO INSTITUTE OF AMERICA
326 Broadway, New York

Please send me information concerning your { HOME STUDY / RESIDENCE } Course of Instruction.

Name .....
Street No. .....
City ..... State .....

PROGRESS

NATURALLY, at this early stage, the Art of Radio Communication is not standing still. It is undergoing a normal evolution.

The low-hung, straight line automobile of today is unlike its cart-like predecessor of twenty years ago, although the principle of locomotion remains the same.

So, too, the design of Radio apparatus advances. Insulated panels and live shafts are supplanted by metal panels and completely insulated instruments —the obvious thing to do, making unnecessary the use of a shield. Unsightly, protruding knobs are replaced by recessed dials and straight tuning bars, permitting fine adjusting without cramping the hand. The tap switch is removed entirely from the panel and becomes an integral part of the variocoupler, being placed *inside* the rotor, thus eliminating all soldering of primary leads.

It is significant that all these improvements have been developed in the Eisemann laboratories.

Descriptive literature will be sent to dealers upon request

EISEMANN MAGNETO CORPORATION
William N. Shaw, *President*
BROOKLYN, N. Y.

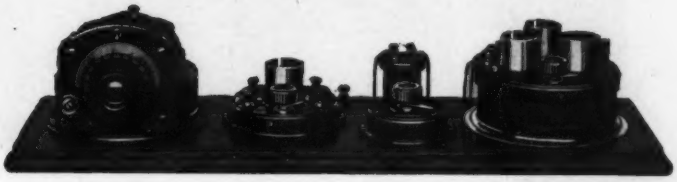
DETROIT CHICAGO

EISEMANN

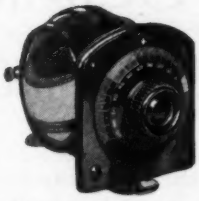
When writing to advertisers please mention THE WIRELESS AGE

ATWATER KENT

Receiving Sets and Parts



Complete Set, consisting of Type 11 Tuner, one stage of Radio Frequency Amplification and Detector 2-stage Audio Frequency Amplification
Other complete sets are shown in the circular.



Mounted Variometer

Standard Tube Detector Unit. Special unit made to take the 1¾-volt tube

2-stage Amplifier
Similar units are made in Detector 1-stage and Detector 2-stage Amplifiers

Standard Vac. Tube Unit

ATWATER KENT Receiving Sets and Parts are built with the most particular care. From the moulding of the condensite forms and winding of the various coils, through the assembling and finishing of the units to the final mounting and wiring, every step is subjected to the most rigid inspection. It must be "just so." This is the reason why ATWATER KENT radio equipment has that "different" look that makes it instantly noticeable in any surrounding.

Atwater Kent products sell on appearance

But appearance is not the only feature that is watched. Even though the factory is pushed to its utmost capacity by the extraordinary demand for ATWATER KENT sets and parts, every unit is carefully tested to make certain that its performance is right. By this means, the radio fan is sure of getting a part or set that is not only strikingly handsome in appearance, but works perfectly, and gives the utmost satisfaction.

They stay sold on quality of performance

Type 11 Tuner

1-stage Amplifier

R. F. Transformer

Potentiometer
Also made for panel mtg.

ATWATER KENT MANUFACTURING COMPANY, PHILADELPHIA, PA.
Radio Department 4946 STENTON AVE. *Write for Literature*

Elegance and Scientific Precision Combined!

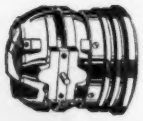
YOU will welcome a Kennedy Receiving Set in your home. Its distinguished appearance lends itself to the most refined surroundings and outwardly reflects the accuracy and precision exercised in its manufacture.

In a cabinet of beautifully finished hardwood and mounted behind a richly polished panel you will find a series of precision instruments—each correctly designed in itself and each exactly co-ordinated with the balance of the set.

Ease of control, long distance reception, elimination of interference and the utmost pleasure and satisfaction in its use are assured with a Kennedy receiver.

Arrange with your Kennedy Dealer for a demonstration. Or write us direct for further information.

THE COLIN B. KENNEDY COMPANY
SAN FRANCISCO SAINT LOUIS

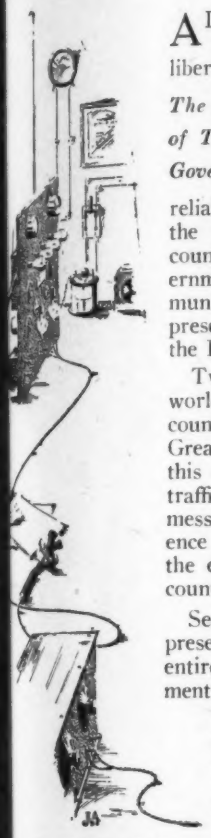


The Kennedy Variometer
This, as well as all other parts, is scientifically constructed by Kennedy artisans. The minute clearance between rotor and stator, the firm windings and positive contact eliminate dielectric losses and increase sharpness of tuning.

KENNEDY

The Royalty *of Radio*

In Our Opinion



The Blight of Too Much Government

ALTHOUGH the English Government, after twelve long years of deliberation and delay, has finally decided to allow private enterprise to construct high-powered wireless stations and operate them so as to provide an adequate and reliable means of communication with the Dominions, colonies and foreign countries, the paralyzing effect of government ownership or control of communication is perfectly exemplified in the present-day wholly inadequate system of the British Empire.

Twelve years ago Great Britain led the world in wireless telegraphy. Now that country ranks fourth or fifth among the Great Powers in radio facilities. While this applies generally to commercial traffic, the lack of facilities for press messages has forced so great a dependence on the cable as to seriously limit the exchange of intelligence with other countries.

Seeking the reason for Great Britain's present position, it is found to be due entirely to the decision of the government, twelve years ago, that the proposed linking up of the whole British Empire was too important, too comprehensive an undertaking for private or commercial interests, and was one which could be successfully handled only by the government itself. Under which policy, in more than a decade the government has accomplished practically nothing.

Meantime the United States has encouraged private enterprise to build one high-powered trans-oceanic station after another, and is freely interchanging intelligence with the rest of the world. France, under private ownership, has built a great radio central at St. Assise, and is also enjoying free and uninterrupted communication with the world at large. Germany is conducting a world-wide service through the privately owned stations at Nauen and Eilvese. Japan covers the Far East and the Pacific, while Italy, Sweden and Poland and several countries of South America are rapidly building powerful stations and will soon join the great family of nations enjoying unrestricted communication with the rest of the world.

The British Isles, however, are not the only sufferers because of lack of proper communication facilities; the nation's colonies waited patiently, but in vain, for twelve long years for a communication system that would keep them in close touch with the mother country and with each other. Tired of waiting for a scheme which never materialized, the great Dominions of Canada, Australia and South Africa have gone ahead independently, making arrangements with private or commercial interests for the erection and operation of high-power stations that will give them adequate facilities for a prompt exchange of business traffic and general information.

England as a nation, however, has been seriously handicapped by the policy of government control of her communication systems, holding rigidly to the limited and inflexible cable, when she could have been enjoying the unlimited and flexible facilities of radio.

Radio, as a means of international communication, already has proven itself by the unparalleled service it has rendered to government, to industry and to world trade, and the nation that refuses to enlist the aid of the initiative and enterprise of private capital is certain to suffer by inadequate provision of its unparalleled facilities for an easy exchange of intelligence.

* * *

Fate of The White Bill

AS had been feared, there was no action on the part of the Sixty-Seventh Congress on the White Radio Bill. In the February issue of THE WIRELESS AGE it was stated to be problematical whether the Senate would reach consideration of the measure before adjournment on March 4. The direct cause of the failure of the Senate to act was the pressure of other legislation, principally the Ship Subsidy Bill. Now this legislation, so important to the radio industry, is delayed, for another year or more, when the same or another bill resembling it will have to be presented and discussed and amended all over again.

Meanwhile, Secretary of Commerce Hoover will have to do the best possible job in reducing interference under the severe handicap of inadequacy of the obsolete, but existing, 1912 law. The conference held at Washington on March 20 was in the interest of all concerned, in an endeavor to find a way out of the present intolerable situation. What transpired there will later be recorded in these pages.

Unless the President should call Congress for extraordinary session—which seems a remote possibility now—patience and tolerance will have to be the watchwords for many months to come, with a continuance of the irksome conditions in broadcasting, which for some time have caused so much annoyance to 2,000,000 listeners.

The failure of the Senate to act on the White radio bill is a certain source of regret to everybody concerned.

* * *

The Radio War of Today

THE war between France and Germany is on again, this time, however, it is only a non-casualty radio war, with France victor in the first round.

For it appears that the feelings of the French were ruffled recently when the Germans, in the course of radiophone concerts from Berlin, inserted some reports on the Ruhr situation and ended the program by singing "Deutschland Uber Alles."

After hearing this a few times the French got busy with the Eiffel Tower station, tuned the transmitter to the same wave length used by the Berlin station and as soon as Ruhr reports began, or the war song was heard, started operation, making the Berlin concerts inaudible through the interference.

And then the Germans were ruffled.

After a few days of this, however, the Germans cut out the reports and the song, and stuck to a straight musical program.

Thus the radio war of 1923 ended. Outraged feelings replaced bloodshed with the entrance of radio into the field of diplomacy.

MARION DAVIES has been heard on the air with a beauty talk, but she has in mind an even more important duty for the radio telephone to perform, with the cooperation of the movies. She wrote a special article to tell you about it. You will find it on page 30

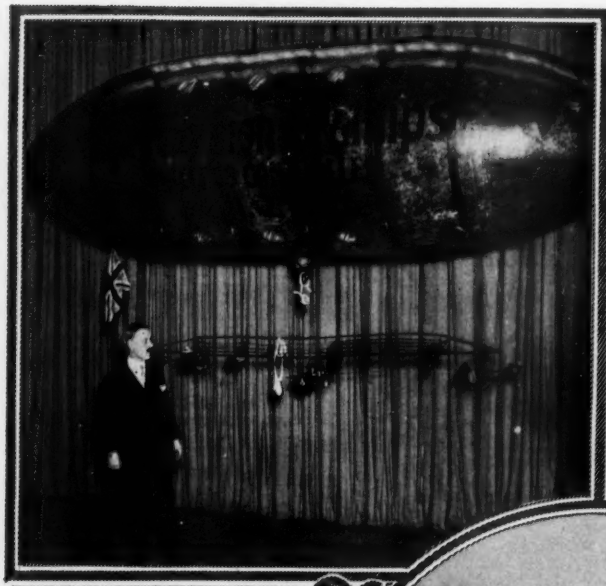
Broadcasting Artists Who Tell of Their Work

MARIA SAMSON, Hungarian soprano, thinks songs of all nations sung by radio should assist Americanization work

TITTA RUFFO has sung in every country except Japan, China and India. His biggest audiences have been radio ones. On page 31 is told why he broadcasts

LILLEBIL IBSEN, granddaughter-in-law of the famous Norwegian author and a dancer of international fame, tells in an interview on page 32 her impressions of broadcasting

Clinching Radio's Claim to Versatility



America has had a radio controlled auto, but England has a wireless-operated model dirigible, the invention of Major Phillips. It has astonished London vaudeville audiences

This little boy is hearing the human voice for the first time. His headset is connected with a powerful amplifier, developed for radio use, but here attached to a microphone into which Miss Clara Cooper speaks

The new Voo Doo in Porto Rico—only this is white magic, not black, and much to be enjoyed. PWX, at Havana, is entertaining these colored retainers on the farm of Senor Pessino

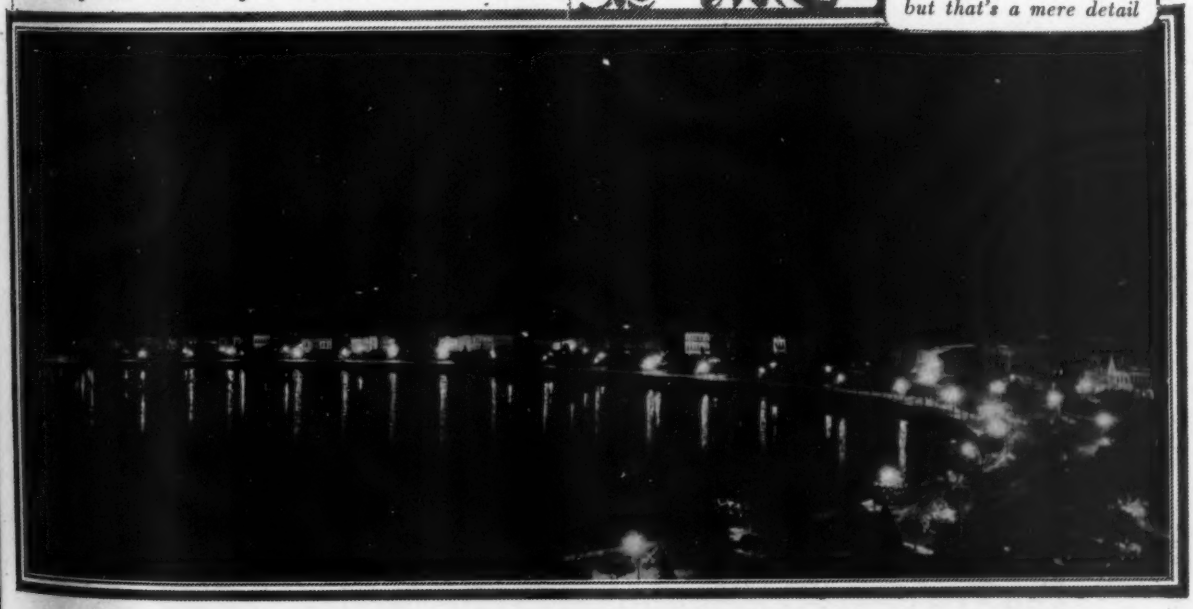
Dr. Albert Abrams, of San Francisco, has all sorts of electric machines for diagnosing diseases, even at a distance, and other doctors are either very enthusiastic or very skeptical. Here he is shown with a new machine that registers love waves—wonder what Cupid thinks of it?

From permanent waves to radio ones—girls of the Y. W. C. A., New York City, learn all about wireless from Miss Abby Morrison, who is a well-known radio expert and an occasional contributor to THE WIRELESS AGE. *These girls may soon be as expert as she is*

New Evidence of Radio's Appeal to All

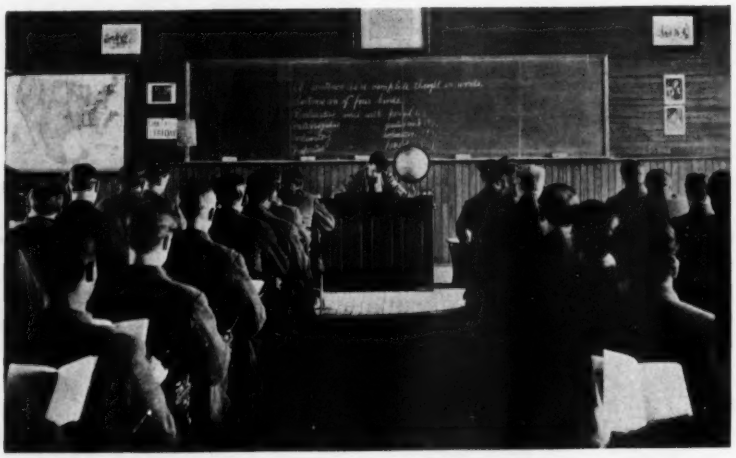
That's not a bank that Master Robert Scott holds in his right hand. Oh, no, it's something much better—a radio receiving set! How tiny it is beside the 50-watt tube

"Bow Wow!" said Strongheart, talking over CFCN at Calgary to invite dogdom to Banff's winter carnival. Of course, it's a loud speaker he's barking at, but that's a mere detail



While Americans have been pestered by a severe winter, South Americans have been enjoying a balmy summer, and nowhere more than here, at Rio de Janeiro, where SPC, the new broadcasting station on Mount Corcovado, now is operating. The light on top of the mountain, seen across the Bay of Botafogo, is that of SPC, which has been giving Brazilians their first taste of broadcasting. Artists do not have to ascend to the top; instead, they perform in a special studio near the entrance to the Brazilian National Exposition, as explained in the article on page 41

Radio Receivers for Prisons—An Appeal



Just one place where a radio set would make men over—the prison school at Auburn, N. Y.

On the opposite page is printed a stirring article by Mrs. Maud Ballington Booth, famous leader of the Volunteers of America.

She says that radio can give no greater service to humanity anywhere than in the prisons, which need the touch and help of the normal world as only radio can give it to them.

Prison funds are not available for the purchase and installation of receivers. If the prisoners, upon whose regeneration the property and even lives of many of us depend, are to realize the benefit of radio, YOU must be the ones to place it within the walls that confine them. YOU must place it within their reach.

The radio impulses that fill the ether and penetrate your home also carry their messages of news, entertainment, and, most important of all, education, into the prisons. It only remains to supply the means of making them intelligible, through receiving sets.

These are the prisons that Mrs. Booth has visited and which she knows can profit greatly by the use of radio:

GIVE RADIO TO THESE PRISONS:

New York
Sing Sing
Auburn
Dannemora
Comstock

Massachusetts
Charleston

New Hampshire
Concord

Connecticut
Wethersfield

New Jersey
Trenton

Maryland
Baltimore

Ohio
Columbus

Michigan
Jackson
Iona
Marquette

Illinois
Joliet

Kansas
Lansing

Florida
Raiford

Iowa
Fort Madison

Virginia
Richmond

California
Fulsom
St. Quentin

Federal Prisons
Ft. Leavenworth, Kans.
Atlanta, Ga.

Will you help give these institutions of correction and education their most important equipment—receiving sets?

Contributions of instruments, funds, and services are needed.

All instruments should be commercial apparatus of recognized worth and excellence. Funds—in such amount as you feel able to give. Inasmuch as they are intended for the charitable radio purposes of the Volunteers of America, contributions are not subject to income tax. Services of experts who live or work in the vicinity of the above prisons are desired.

THE WIRELESS AGE will act as treasurer and custodian of the funds and apparatus for the Volunteers of America, and will give the advice, co-operation and services of its staff and representatives in assuring the success of each prison installation. In addition, to each prison in which a radio set is installed through this appeal, a set of radio books will be given:

BOOKS TO BE CONTRIBUTED BY THE WIRELESS AGE:

Modern Radio Operation, by J. O. Smith.
An Introduction to Radio.
Practical Wireless Telegraphy, by E. E. Bucher.
Wireless Experimenter's Manual, by E. E. Bucher.
Radio Telephony, by Dr. A. N. Goldsmith.

These books give popular and technical information covering all phases of radio, and enable both the poorly-educated man and the more intellectual one to understand the subject.

Send all letters to, and make checks payable to

The Wireless Age—Volunteers of America Radio Fund

326 Broadway, New York City

(Contributions will be acknowledged in THE WIRELESS AGE.)

Radio's Chance in the Prison

Need for Radio Receiving Sets in the Penal Institutions Everywhere — Great Woman Humanitarian Appeals for Equipment

By Mrs. Maud Ballington Booth

(Famous Leader of the Volunteers of America)

Mrs. Maud Ballington Booth

WHEN I talked over the radio, from a broadcasting station in New York, I at once realized the wonderful cheer and help that could be brought through this miracle of modern times, to those shut away behind prison walls. I have already given twenty-six years of my life to our country's prisoners and have studied earnestly all phases of prison reform. I naturally asked myself how could radio help those men to better themselves.

Perhaps no one in this country knows the prison world better than I do, for I have traveled from prison to prison, from New York to San Francisco and from Maine to the Gulf, year in and year out for a quarter of a century and you will readily understand that I have had time and opportunity to study not only the subject of prison reform but to learn to know the men themselves. I come into personal touch with them, and to me they are not criminals tagged by the name of their crime — "burglar," "forger," "pickpocket." They are men, individuals, my personal friends; and I can truly say that my knowledge of them has taught me how well worth saving they are.

There was a time long years ago when prison was spoken of and thought of as a place that could be likened to the junk heap for the human family. That which was worthless, broken, vile, good for nothing, was cast there and surprise was expressed if you spoke of the possibility of these men coming back to live lives that would be good, worthy and worth while after a prison experience.

Thank God, the world's viewpoint has vastly changed. Not only has prison reform within the walls made mighty strides but on the outside, people realize that prison is a place to reform and make men over, not to break by mental and brutalize them by physical punishment. We realize that prisons must be to the morally faulty what the hospital is to the physically unfit. The larger the number of cures, the better the prison and its methods. A prison today must not be judged by the amount of money its factories earn for the state, but by the number of good citizens it can turn out.

Of course in all work for those who have broken the law and sinned against right living we can only succeed if we start out with the firm belief that they are worth saving. It is for those who work with and for the prisoners to find the grain of gold that exists in every heart, even amid the dross of an evil past. To those of us who believe in the miracle working power of Divine Love and aid, there is no room for doubt and pessimism.

This may seem a roundabout way of starting an article on radio for the prison, but I want my readers to divest their minds at the outset of the miserable fog of old prejudice regarding prisons and prisoners.

If we look for a new and better future for these men and women within the prisons, we must bring into their lives all the good inspirations and influences that will help them; and in this it seems to me that radio can be considered as an invaluable aid.

When I first began my work for the prisons there was very little brought into them from the outside world. No lectures, concerts or messages from the civilization that they had left entered those stern walls and in many prisons they never saw a daily paper, but lived lives that were absolutely cut off from the world of the living. It was as if they had been consigned to a tomb, forgotten, except by their own wives, mothers and dear ones. Alas, as many of them were friendless they passed years and years without a letter or a visit or a touch of sympathy from the outer world.

In some of the prisons they have libraries. Sometimes really good ones, but from the blessed companionship of books the illiterate were shut out. The work that they did in the shops was often of the monotonous kind that occupied the fingers but did not interest or develop the mind. Some prisons possessed not even the help of a library. One that I visited had not even a Bible, only six torn and tattered hymn books. I gave them at once a little library of two hundred new books which New York publishers sold me at a very generous discount. This stirred up the interest of that state and before long they had a fair collection of books.

Now the view often taken of the prisoner is that he is embittered against

The daily grind of hard, unending labor in the prison at Fort Leavenworth, Kans., is ended only by imprisonment within the cells, of which the above are a fair example

society and sits in his cell brooding and plotting how to get even with those who have enforced the law against him and making new and ingenious plans for the perpetration of crimes after his release. To those who know prison conditions of over twenty years ago this might seem a very natural outcome of long dreary hours of idleness, and unfortunately in many cases it was.

It is different now.

Let me tell you the story of an old timer in Menard, the Southern State Penitentiary of Illinois. His sentence was over and he stepped into the Warden's office to say good-by. As he smilingly shook hands he said, "This is the last time, Warden. I am never coming back again." The Warden laughed and patting him upon the back said, "Ah, but you have been in several times. Why do you think you will never come back?"

With a smile he answered: "It is quite different this time. I'll tell you about it. When I served time before I didn't know anything. I could not read, I could not write; I never had an education. After the day's work had been done I went into my cell and sat there thinking, and I had nothing good to think about.

"I would just think over the old times and go back to the old places in my mind and I was always lonely, but when I came to prison this time they had got the school started. I went to school, I learned to read and write. I got some education. Then when I could read I got some books and every night in my cell I could read what other people had done in the world. I read history and I read about travels, and I read what other people think and do, and I was never lonely any more. I saw a new wide world that I had never known anything about.

"Now I am going to be honest and work. I have tried to do that before and then when I got to my room each night after my work I would be lonely. I would have nothing to do, nothing to think about that was good, and if I went out and mixed with the old companions, then I got into trouble. Now after my day's work is over I'll be able to go to my room and read books or be able to read the papers and see what is going on in the world. I'll never be lonely and I am sure I will be able to keep out of trouble."

Guard's eye view from the wall enclosing Auburn Prison and shops

So, smiling and happy, he went out to face life with this new gift that had been given him. This education, limited as it was, had opened his eyes to a new world he had never known before.

Now to show you that the prisoner himself wants to improve his mind and prepare for a better future, let me cite the prison at Columbus, Ohio, of which Mr. P. E. Thomas is warden. There are fifteen hundred correspondence courses being taken there and these men are studying every night in their cells after the day's work is over. Does that not speak volumes for their desire and ambition to improve their opportunity?

These Prisons Need Radio Sets

New York	**Michigan**
Sing Sing	**Jackson**
Auburn	**Iona**
Dannemora	**Marquette**
Comstock	**Illinois**
Massachusetts	**Joliet**
Charleston	**Kansas**
New Hampshire	**Lansing**
Concord	**Florida**
Connecticut	**Raiford**
Wethersfield	**Iowa**
New Jersey	**Fort Madison**
Trenton	**Virginia**
Maryland	**Richmond**
Baltimore	**California**
Ohio	**Fulsom**
Columbus	**St. Quentin**

Federal Prisons
Ft. Leavenworth, Kans.
Atlanta, Ga.

In many of our prisons there are very successful schools for the illiterate and those who need them are marched to the school room when the others go to the work shop. The school work is made an essential part of their prison work. In other prisons it is a night school that does this valuable service.

Still I have not reached the radio; but I think you can see that I am getting there by degrees.

I realize that to talk of "Radio for the Prisons" will at once make some people—the sort who speak before they think—cry out against "entertaining and pampering prisoners." Let me remind you that all work and no play—or should I say, *recreation*—has always been found to have a dulling influence on the human mind, retarding its progress. Giving of some good clean interest or amusement at proper times to the men in prisons has been found by our wardens to improve the discipline and morale of the prison population.

Saturday afternoon baseball games, relaxation periods each day in the prison yard, and moving pictures once a week, a concert every now and then—these are thoroughly approved by even the most conservative of our prison officials.

I confess that I am conservative. I believe more emphasis should be laid on education and instruction and that entertainment should not be over-emphasized in prison development. Movie shows and concerts every night seem to me unwise, for they are not possible even in the life of the honest working man enjoying his freedom.

But I do not feel that radio stands only for entertainment. It is contact, helpful contact, with the outside world of thought and progress. Through the air can come not only wonderful music and thrilling voices in song, but messages of inspiration from the great minds of our country and all sorts of lectures on educational subjects.

Think what it would mean to men studying night after night in their cells, to hear the voice of some great authority speaking clearly and helpfully on the very subject of their study, just as if the lecturer stood in their midst.

When radio is installed in our prisons I myself hope to be able to talk to scores of prison audiences at one time, whereas it now demands thousands of miles' travel and weeks of time to reach them individually. I have a wide influence in the prisons where the "boys" have adopted me as their "Little Mother" and I long for this more constant touch with them, that will then

One of the rare celebrations in the prison yard at Auburn, N. Y. They don't look any different from the rest of us, do they?

be possible. Then it occurs to me that many of our great men, men whose thought counts for a great deal can through the ether, send a message of cheer and inspiration, whereas they could not possibly drop their own work to travel to the prisons.

Now you will understand why I want to see installed in all the prisons named in the accompanying list, a good radio receiving set with loud-speaking device that can be used in the Prison Chapel.

Will you help me in this enterprise?

You have the interest and enjoyment that radio brings right into your own home, but you can still go out to the concerts, can hear your favorite preacher, see your new play and go to the movies, while these "boys" are shut in.

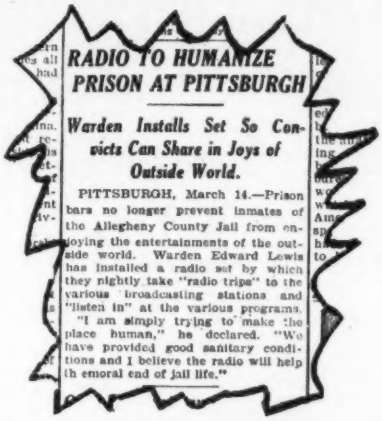
The radio would mean so much more to them than to those of us who have our freedom.

Will you not send to them your message of good cheer with the wish that they too may come out into the world some day to make good? Perhaps the Kiwanis Clubs and Rotary Clubs in the different states will make this one of their kindly acts for their own state prisons.

Next month I hope to give you a message from some of our leading wardens on this subject. As the "Little Mother" of the Nation's Prisoners I ask you to help them generously, and do it now.

You may send receiving instruments, or checks, but preferably the latter, as for best results each prison installation should be assembled by experts making use of pieces of apparatus designed to function together. Send all contributions to The Wireless Age, 326 Broadway, New York City, which will act as custodian of the fund and will see that it is wisely spent for maximum results.

Humanizing the Prison



RADIO TO HUMANIZE PRISON AT PITTSBURGH

Warden Installs Set So Convicts Can Share in Joys of Outside World.

PITTSBURGH, March 14.—Prison bars no longer prevent inmates of the Allegheny County Jail from enjoying the entertainments of the outside world. Warden Edward Lewis has installed a radio set by which they nightly take "radio trips" to the various broadcasting stations and "listen in" at the various programs.

"I am simply trying to make the place human," he declared. "We have provided good sanitary conditions and I believe the radio will help th emoral end of jail life."

Here is what the Warden of the Allegheny County (Pa.) Jail thinks of radio, as reported by the N. Y. "World." What this one warden has done scores of others would like to do—with your aid

Reaching the Foreign Born

Announcement by the United States Public Health Service that the broadcasting of health information by radio had been resumed by request, was good news to millions of foreign born residents of America. It meant the continuation of the "health talk" columns in the foreign-language newspapers of the United States.

Teaching good health by wireless is nothing new to the millions of radio fans in this country, but there are several million men and women in America who cannot take advantage of these radio broadcast health talks because they do not have complete understanding of the English language. There are more than thirteen million foreign born residents in the United States and many of them are still dependent upon their own foreign language newspapers and organizations for all their information about what is happening in America.

To reach this great body of men and women, with its gospel of better health, the United States Public Health Service has arranged to give copies of these radiograms to the Foreign Language Information Service, 119 West 41st Street, New York. This organization is non-partisan and co-operates with the departments of the Federal Government, the foreign language press, and foreign organizations, in informing the recent immigrant regarding our government and laws, and the facts and factors in American life that he needs to know.

It tries to answer the questions that puzzle him and help him improve his every-day life in the home. The Foreign Language Information Service sends out its material in sixteen languages: Czech, Slovak, Danish, Finnish, German, Hungarian, Italian, Jewish, Serbo-Croatian, Slovene, Lithuanian, Norwegian, Polish, Russian, Swedish and Ukrainian.

71 Per Cent. Radio Village

What is claimed to be the most completely radio equipped town has been discovered near Chester, Pa., where Westinghouse Village, a small community of 200 homes, has 142 radio receiving sets. This is 71 per cent. of the houses. The village has no motion picture or other theatres, and depends solely upon radio for entertainment within its precincts.

KDKA Re-Broadcasting from 100 Meters

Cleveland, Ohio, despite the fact that it is comparatively near KDKA in Pittsburgh, has not been hearing that station with any great success. Apparently Cleveland is one of those mysterious "dead spots" within which radio waves from distant transmitters penetrate very weakly, if at all. Clevelanders however, recently have been hearing KDKA very clearly by means of retransmission.

This has been due to the development and operation of a new transmitter at KDKA, operating on 100 meters, allowing a separation which enables it to transmit simultaneously with the 360-meter wave. The programs on the 100-meter wave are picked up by station KDPM, the Westinghouse broadcasting station in the city of Cleveland, and retransmitted on 360 meters, a special receiving set tuned to 100 meters being connected through suitable amplifiers to KDPM's 360-meter transmitter. This experiment with 100-meter transmissions for relaying has been entirely successful and is considered to mark a new achievement in radio telephony.

Transmission on 100 meters does not interfere with any other listeners, as there are only a few receiving sets in existence that can tune to such a low wave length, and no one therefore hears it except the engineers possessed of special instruments.

Radio No Rival to Newspaper

The radio broadcasting station will not supplant the newspaper. That is the opinion of Chester S. Lord, editor, author, and one of the foremost newspapermen, having been managing editor of the New York *Sun* under the late Charles A. Dana. He bases his opinion on the fact that although radio broadcasting already is highly developed it shows no signs of injuring the newspapers, and that radio requires listeners to adapt their time to it, while newspaper readers can choose their own time in which to read. The one supplements the other, Lord thinks.

"K" Calls Are Western

The Department of Commerce now is issuing broadcasting calls starting with "K" to applicants west of the Mississippi River, and confines the "W" calls to the territory east of that river. The new system means that the location of the station as eastern or western will be evident from the first letter. However, all previous calls issued will be unchanged, and eastern stations already listed under "K," such as KDKA, will retain their original letters.

"DO not kill patriotism in immigrants, but cultivate it by radio. Then you can transform it in all its power into Americanism."

Suggestion of an Hungarian Soprano

Maria Samson

As Made to Claire Bell

Maria Samson

BROADCASTING is an American institution, and by far the greater portion of the matter that the radio telephone places on the air of the world is American, in language, music, and in the nationality of the performer. Yet there is one petite little lady who thinks that the great opportunity offered to radio broadcasting is that of transmitting the voices and music of other lands. Hers is a new note in radio, and in America, and even in ideas of Americanization.

Insists on It

She is Maria Samson, lyric soprano, who has been heard from stations in Davenport, Ia., Tarrytown, N. Y., Newark, N. J., and Atlantic City. Born in Transylvania, Hungary, she is a Hungarian, and she always includes a Hungarian song among those in other languages, French, Italian and English, which she has on her repertoire. It is not easy to add a Hungarian song to her recital, because Hungarian music is difficult for pianists of any other nationality to play. But she always insists on singing one of her native folksongs, despite the difficulties, because she knows what they mean to the Hungarians who are listening-in.

She knows what it means to them because she has had hundreds of letters from them after each performance by radio; letters written, almost invariably, in Hungarian. Some of them on expensive stationery, evidently from homes of affluence. Some of them crude scrawls on torn scraps. Some of them showing grease spots and finger marks. Some of them—ah, some of them show the stains of tears.

"Thank you, oh, thank you from the bottom of our hearts for singing our beloved old song for us," they all say, in substance. "It has been so many years, so long, so long, since we have heard our music. It seems to come direct from Hungary, nay, from God Himself, as we hear it by radio."

Mlle. Samson has been in this country for only a year and a half, yet already, as a result of her experiences in singing in concerts in all the important cities, and particularly from her radio experiences, she has sensed one of the difficulties in which America finds herself. How shall the vast foreign population be made truly American?

And here is her answer: When you try to crush out of existence the immigrant's love for the Fatherland and its manners, customs, music and traditions, you are endeavoring to destroy that which makes a man a man, and a woman a woman. How can you destroy love of country, and create patriotism at the same time? You cannot, thinks Mlle. Samson. So she would have these groups of strangers remember their lands across the sea, preserve their memories and folk-lore, sing their songs, dance their dances, in this new country that offers them so much more than the old ever could. "In respecting the old, let them learn to love the new."

And what better medium for coming in contact with both old and new than the radio telephone broadcasting services? There is the opportunity of the radio—to give to the foreign groups not only American music, American voices, songs, ideals, but also to perpetuate the old, by special programs of varied nationality, representing each one of the "old countries."

Pathetic Letters

"Some of my letters come from just 'Hunkies,'" said Mlle. Samson to me with a sympathetic smile. She speaks with an accent that is quite French, and uses simple expressions, with only an occasional odd twist, as does a cultured stranger who is just learning the language. "I can see that they have been a long time in this country, because they forget how to write the Hungarian almost, and they make such mistakes as make you laugh and cry too. I have one letter that is so innocent and naive, so touching, from a young girl who loved the Hungarian song I sang by radio and thought that I was singing it just for her because she had asked me in another letter to sing it. That was just an accident that I sang it.

"Some of the people tell me that I made them cry, because they had forgotten the old land, and the song they used to sing made them remember for the first time in, oh, always it is many years.

Hungarians Respond Eagerly

"I think that all Hungarians have the radio. I sing many songs in French and Italian and English, and I get letters about those countries too, from everywhere in this big country of yours, but not so many as from my Hungarians, and none like them. They have been—what you call, ah, yes—starved for their music. The Hungarians, everywhere they write me, from New York and Iowa and Nebraska and way up north in Canada. It was too bad I went away after I sang in Newark, because my people here tell me that all day long the telephone rang with Hungarians to thank me. They got my number, I guess, from the Hungarian newspaper *Amerika*, in New York. It is so nice to give pleasure to people, and now I want to give a special Hungarian program for them by radio some day."

So that is something for the radio audience to look forward to. It takes a Hungarian to play and sing the native music of Hungary well, as those who have heard it know. Then it is exceedingly pleasing, even exciting at times.

But Mlle. Samson knows the music of other lands than her own. Her studies began at an early age, and led her to the Royal Academy in Budapest, where she received the highest awards on graduation. She then sang on the stage of the Royal Opera House as leading soprano, appearing in sixteen different rôles, among them Butterfly, Mimi in La Bohême, Mignon, and Micaela in Carmen.

"Give Truth the Open Field—"

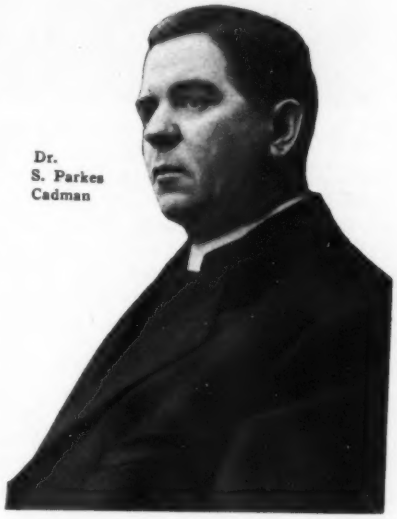
"And I Fear Not Though All the Winds of Doctrine Were Let Loose to Play Upon the Earth. Let Her and Falsehood Grapple; Who Ever Knew Truth Put to the Worse in a Free and Open Encounter?"—*John Milton*

By S. W. S.

I KNOW that when I finish writing this article I will be dissatisfied with it. And probably you also will think that what I say here falls far short of the truth in the matter, if you are one of those who have been moved by church services transmitted by radio, and particularly by the Men's Conferences of the Bedford Branch Y. M. C. A., Brooklyn, and more particularly still, by the oratory of Dr. S. Parkes Cadman.

The subject is one which deals with those most imponderable things, the human emotions; with those thoughts that are wordless even to those who think them; with those feelings that are sacred to those who thrill to them. It means writing of that which brings tears to the eyes of each listener; it calls for invading the sanctity of the innermost being; the being that instinctively resists the blare of words and lives most abundantly only when bathed in the secret light that shines within the soul.

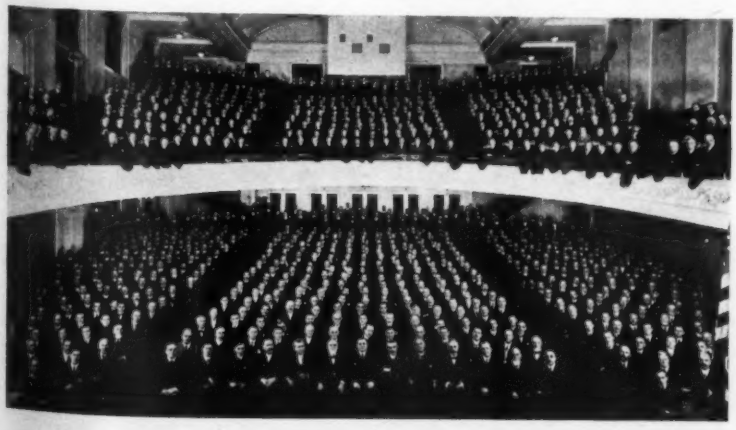
As I write my radio receiving set is close at hand. It has brought to me at home the classics of literature and of music, the works of our contemporaries, often their very voices. It has brought pleasure. And though I instinctively shrink from admitting it, pain also has come—the keen swift shock of realization that I am less than I would wish to be; that, in the familiar, half-forgotten words, I have done the things I ought not to have done, and left undone the things that should have been done.



Dr. S. Parkes Cadman

And right here I pause. The phrases to transfer this emotion to paper won't come. For there are things that cannot be said, not only because there are no words to fit them, but because within all of us there is an imperious something that is an impregnable barrier between the world and the inner being. Some facts, some emotions cannot ever be told. So complete the line of thought in your own manner, according to your own experience. . . .

How many of us had neglected the church because it had grown away from us or we from it, only to find today that our paths have met again through radio?



Here is how Dr. Cadman packs them in every Sunday, with the limit of standees in the back. The home audience of men, women and children is many times as big

There are multitudes. Hundreds of church services have been broadcast since the first one was put on the air at Pittsburgh. Practically every creed, certainly every important denomination, has broadcast its worship.

Ministers who once scorned radio as too undignified to serve them, now are eager to avail themselves of it, because they have seen the almost miraculous results of the broadcasting of church services.

Consider just one specific case of religious broadcasting, one that has impressed me and thousands of others.

Dr. S. Parkes Cadman for twenty years has been addressing the Sunday Afternoon Men's Conferences held by the Bedford Branch Y. M. C. A., Brooklyn, N. Y. The sessions are for men only, but since last January they have been broadcast each Sunday by station WEAF. In response, have come hundreds of letters of the most appealing character, revealing a new stirring of souls in a congregation vastly larger than the 1,100 who sit and stand before Dr. Cadman once a week. Some of those letters are reproduced on these pages.

Dr. Cadman is a busy man, for he is pastor of the Central Congregational Church in Brooklyn, and he also does a great deal of traveling, delivering lectures in many cities. But he agreed to see me by appointment. I made my call short, my words few, and my questions brief.

"What has your experience with radio led you to consider as its most important service?" was my first query.

Like a flash, with that unhesitating flow of decisive, clear English that marks his utterances, he replied: "Unquestionably the humanitarian aspect. There are so many thousands of persons shut in by illness, disability of one kind or another, who can never more come in personal contact with any save those who visit them in their homes. They cannot go to church, nor to the theatre or the concert. Radio is God's blessing to them, and many of them have been moved, deeply moved, by God's Word received by radio, as revealed in scores of letters I have received. I cannot stress too greatly or emphasize too strongly the tremendous influence that radio is having upon these unfortunates who now, for the

first time in all history, have the barriers that separate them from their fellows swept away."

"But," I objected, "radio transmits every conceivable kind of matter, jazz, operas, lectures on everything under the sun. Do you think it is all good?"

"Of course not. It never will be all good unless you weed out all the liars, fakers, thieves and blatherskites, muzzle the pulpiteers, and bring about the reign of the Kingdom. Yet I do not think that there is anything to fear from the miscellany that is sent forth by radio," and he quoted the words that appear at the head of this article: "Give Truth the open field, and I fear not though all the winds of doctrine were let loose to play upon the earth," which is from John Milton's "Areopagitica," a speech before the Lords and Commons of England protesting against the proposal to establish a literary censorship.

Continuing without a pause, he said: "The fact that the listener cannot see the speaker, and so cannot come under the spell of his personality, is one of the great advantages of radio. It means that all the demagogue's histrionism is negatived. No gestures, no frantic fanning of the air, no eye-rolling, are perceived. The speaker has to make his impression solely by the solidity of his word. It is his message alone that counts by radio. If all those who have to address the public had to do so in this manner, the world would soon learn the difference between the learned and the numskull, between the patriot and the politician, as they cannot easily perceive now through the mist of mock heroics which some of our most popular men cast about themselves for the befuddlement of the beholder! Of course, one must not 'walk so far ahead of the sheep that they cannot smell the salt,' and it is necessary, therefore, to make your word solid, yet not too firm for easy digestion and comprehension by your hearers."

Outside the Bedford Branch Y. M. C. A. before a meeting—is not this a magnificent tribute?

There is no doubt about Dr. Cadman's words being "solid."

I expressed surprise at his astounding ability in answering the questions that are put to him each Sunday, and learned the secret of his ability, which is this: Years ago, when he was the pastor of a struggling church in downtown New York, he hit upon the idea of offering to answer questions on any subject, as a means of gaining the interest of the public in church topics. The questions came thick and fast. If he didn't know the answer, he gained everybody's respect by saying so. Such confessions have become fewer and fewer, however, for the questions have a way of falling into classifications, and of repeating themselves.

There are, first, Biblical queries, such as whether or not Jesus had brothers, and whether or not Balaam's ass really spoke. (A pet answer to the latter is: "Yes, an ass speaks every time we hold a meeting!")

Then there are leading questions on controversial subjects, such as the basis for antagonism between specific groups or races, which do not get an answer of any kind.

The third class of queries deals with current events.

Dr. Cadman specifically disclaims

Brooklyn, N. Y.

One of your "Listeners-In" on Sunday afternoon for the last three Sundays has been a young girl, stricken in her early youth by spinal meningitis, and who, for sixteen years, has been a helpless invalid, unable to move but slightly, and quite unable to speak.

Her hearing, eyesight and mentality are perfect, however, and when a young friend installed a home-made radio in her room three weeks ago, her joy was unbounded; for so many years she has been denied a church service and now with your wonderful service in the afternoon, her happiness is almost pathetic.

Her nurse tells me that you requested your "Listening" audience to report through letters, and I want to tell you how marvelous this new way of reaching the shut-ins seems to this household, and we sincerely trust that nothing will prevent the continuation of this work.

Remson, N. J.

Last Sunday afternoon I enjoyed service so much that I informed some of my non-church going friends to come in this Sunday afternoon and hear something good for them. So this afternoon I had the pleasure of having eleven of my friends with me at the time I tuned in to your service and it was enjoyed by all. Among these friends present were some that had never heard over the radio before and I felt glad that the first experience for them was one of good Christian Service so that it would help make the now wonderful radio broadcasting more wonderful and appealing for this fact. I myself have not been to church in over a year, although a church member for many years, and this service made me feel that instead of listening in to such a wonderful service as this was I ought to be there in person to make it feel more wonderful to me and to those of my family who were listening in and for them to feel that in the singing of the anthems that I was among those who were in this manner trying to feel and show that I felt as a good church member should and was doing my bit in a great work. Like the announcer remarked this afternoon, I should be at the service and not listening in to it and to leave that for them to do.

Philadelphia, Pa.

On arriving at the lunch table yesterday, one of the men who frequents the table, and who is a Hebrew, was telling of the most wonderful talk which he heard, over the radio, at his suburban home in Langhorne, Pa. (about 20 miles from Philadelphia). He was reciting at some length the wonderful talk of Dr. Cadman, entitled the "King's Highway," and made particular reference to the inclusion of the Jews in the prayer of Dr. Cadman. The enthusiasm with which this talk was recited at the lunch table by this man, would certainly have been appreciated by Dr. Cadman, and when I told him I had actually been present at the meeting, his enthusiasm could hardly contain itself.

I am dropping you this line so that you will know, at least to a small degree, how effective your meetings are through the broadcasting, and how wide is the influence of Dr. Cadman's voice.

any particular credit for his often spectacular performance in replying to questions, feeling that any man with a similar education and experience could do as well.

These questions and answers are but a part of the Men's Conference. An address precedes them, a sermon; and while the questions are an intellectual delight, it is what Dr. Cadman says in his sermons transmitted by radio that appeals so greatly to the hearts of thousands.

Because he had more time to give me than Dr. Cadman, I went to Mr. Halsey Hammond, secretary of the Bedford Y. M. C. A. for some specific facts reported by the radio audience and I learned some extraordinary things. For instance, on one Sunday afternoon recently the churches in Cornwall-on-the-Hudson, N. Y., united in the Episcopal church there to listen to Dr. Cadman's service. They heard, near the close of the Conference, this:

"Do you think that all churches should get together?"

"I do. I would like to see all the churches in New York get together tonight."

In another case, a man in Wallace, N. C., wrote that he had organized a group of fifty people to listen. Still other groups of families, neighbors and friends have been reported from towns scattered over practically the entire territory east of the Mississippi.

In one week recently the number of people who wrote to the Y. M. C. A. regarding the Broadcast Conference exceeded the number in actual attendance in the auditorium, which each Sunday has a capacity crowd of 1,100, including the maximum number of standees.

A doctor and a self-confessed atheist wrote: "'Almost persuadest thou me to be a Christian.'"

A mother said that the radio Conference had solved her problem of keeping her two sons home on Sunday afternoon, observing the Sabbath and instructing them in religion.

A nationally-known financier in Philadelphia listens with the greatest interest, writes his physician in an evident vein of relief.

People by hundreds mail requests for the singing of old-time hymns, some of them so old that they cannot be found in present-day hymn books, yet sung they are, and frequently the written thanks tell of the tears that fell at hearing the hymns of the childhood of long ago.

People by thousands write just a plain "thank you."

"Broadcasting the Conference seems really to have met a need in the lives of the people," said Mr. Hammond.

It does even more than that—it meets and fills to overflowing the needs of people's souls.

The Gloria Trumpeters who delight Dr. Cadman's audiences. They are: Katherine Williams, Louise Gura, Cora Roberts and Mabel Coapman. The quartette was formed in 1914, and has gained wide fame in church, Y. M. C. A. and other appearances

Freehold, N. J.

This is just a word of appreciation of your Sunday afternoon Conference. I have listened in for the last two Sundays of January and have thoroughly enjoyed Dr. Cadman's address, in fact, the whole address. You know it does us good as preachers to hear a fine message from someone else. There are three of us here listening and some others in the town also that I know were listening in on their own outfit.

I am glad of the good that you are doing with the men of Brooklyn, and am glad also that the work is not confined to your four walls. Men who do not attend church may by the radio receive some of the blessing.

May the Lord bless your efforts and crown them all with success.

(From a minister).

Jersey City, N. J.

Please excuse pencil and writing, but I am unable to hold a pen, as I am sick and have been for (12) years, so I am a shut-in, but I want to tell you how much I enjoy the services Sunday afternoon.

It is very kind of you to let the home folks enjoy it, Dr. Cadman is a wonderful speaker, you all speak so plain and loud and the singing and trumpeters are just grand. Sunday morning I listen to the church services, the concerts during the week are nice, but I do look forward to Sunday, for I enjoy it the best. I always went to church when I had my health and strength, but when not able to go to church, what a blessing to have a radio. I am a member of the Second Presbyterian Church of which Dr. Henry Cronin is pastor. He comes to see me, and I do enjoy his visits when I can see him. Sometimes I am so awful sick that my doctor will not let any one see me.

I received my radio for Christmas from the doctor that takes care of me when my doctor is away, they both are taking care of me for nothing, both good and kind. My doctor has been looking after me all these years. He is a good Christian man.

U. S. Stations Heard in Hawaii by Retransmission

RADIO listeners in Hawaii, on January 20, again listened to Pacific Coast broadcasting through retransmission by KDYX, the station of the "Star-Bulletin" in Honolulu. Broadcast programs from KHJ, Los Angeles; KGW, Portland, Ore.; and two others were picked up by Receiving Engineer Corey at the Radio Corporation of America's station at Koko Head, and transferred to a land wire running direct to the radio transmitter in Honolulu, where they again rode on the air.

This was not the first time that such a feat has been done, but it had not been accomplished with such perfection as marked the test on January 20, which ran for an hour and a half. KHJ and KGW were the two stations that were listened to for the majority of the time, the two others being picked up for only a few minutes.

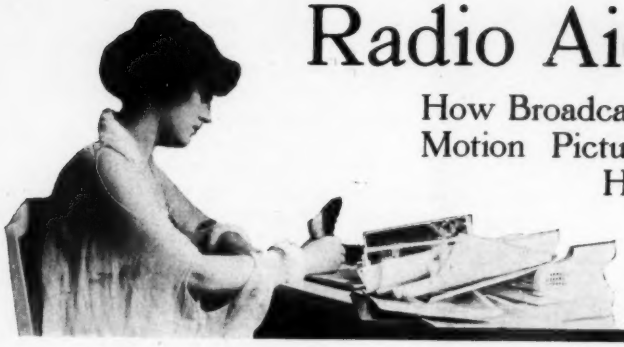
A special receiving set, designed and made for the purpose by the RCA engineers at Koko Head, was responsible for the great success of the test, which is considered as indicating that regular programs from the States can be provided for the entire Hawaiian group practically at will.

Stamford, Conn.

It will be a tremendous loss to the radio public if the Sunday P. M. Conferences are discontinued.

There are church services a plenty but only one institution like this Conference with that marvelous-minded Cadman. I wrote WEAF after last Sunday's Conference that they had done a fine piece of work in adding this to our Sunday blessings and I hoped they would continue it. If your listeners-in feel as I do, the response will be so unanimous you can't help it. To my mind, it is the supreme event of the week.

For years I have been shut in on my outdoor porch bed. The radio has brought the world back.



Radio Aid for the Movies

How Broadcasters May Co-operate With the Motion Picture World—Great Opportunity Has But to Be Seized

By Marion Davies

After Marion Davies broadcast her talk on making up for the movies, I asked her if she didn't think it had helped many people.

"Yes, of course," she said. "If you could see my mail! Make-up is so important, and I am sure my little talk will help a great many to win success in their first trials before the movie camera.

"But that isn't but a small fraction of the good that radio could do—why I could write a book about the opportunity radio has!"

"Why not write a short article?" I suggested. "That might help the broadcasters to seize their opportunities, as you see them."

"I will," she promised.

Here it is. —G. W. G.

HAVING had the interesting experience of broadcasting messages over the radio a couple of times I have become very much interested in the development and possibilities of this wonderful new invention which is bringing instruction and entertainment to millions of people. Every day one reads of some new use to which this force can be put.

We read of Dr. Simon Flexner announcing over the radio that bacteriologists at Rockefeller Institute have discovered how to isolate the deadly flu germ. Can't you just picture the thousands of family circles scattered throughout the United States who receive that welcome news—of the thankful comments which follow? The best part about radio is that an entire group receives the same momentous piece of information at the same instant. They converse on it while each one has it fresh in his mind and is enthusiastic over it.

I have been wondering why more cannot be done to acquaint the people of the country by means of the radio of what is going on in the motion picture world. My little experience in giving a talk on "How to Make Up for the Movies" convinces me that the radio is a wonderful source of power for disseminating news connected with the screen.

The motion picture industry is developing by leaps and bounds right along. Every day new experiments are being made in settings, lighting, the types of stories to be portrayed, and in the way they shall be presented on the screen. Of course all this is told in the daily press, but why would it not be possible to have some one person appointed as the radio movie editor? His duty would be to keep track of all the important news connected with the screen world and present a snappy, condensed account of it, say once a week by means of the radio. So many, many people are interested in both the radio and movies that this could not fail to make a hit.

Of course the person appointed for such a task would have to be absolutely impartial in his attitude, and be connected with no particular company. He would serve somewhat in the same capacity as an editor of a big metropolitan daily, selecting certain items to broadcast because they were news, rejecting others because they would not be of sufficient general interest.

The value of such a movie news service would lie in the fact that in every home in the land which boasts a radio outfit, there is bound to be several "movie fans." After the recent talk which I gave on make-up I received thousands of letters from all over the country, mostly from young girls, but many from older men and women, telling me how much they had enjoyed the talk and that hearing my voice after seeing me on the screen was almost like meeting me in person.

This alone shows the immense interest there is in motion pictures and the people who are making them. For that reason a "Radio Movie Editor," if he knew how to select his news and how to make his talk bright and interesting, would undoubtedly be welcomed by radio fans. Such a man could carefully study motion picture news in the press and the magazines and then once a week regale his vast audience with what he had learned. The program could be varied by talks by well-known stars shortly after the time a big picture is released simultaneously all over the country. The star of the production, if it turned out to be a big success, might tell by radio in New York or Los Angeles, how she enjoyed acting the leading rôle, describe the difficulties she encountered, and recount any other interesting facts connected with the making of the picture.

Also, the musical scores which are nowadays especially written for big screen productions, might be broadcast by the full orchestra which furnishes the music at the theatre when the picture is shown. I know that this is being done in New York, and I think it should be done elsewhere, too. I know that for my Cosmopolitan picture "When Knighthood Was in Flower," we had a special musical score written by William Fred Peters and presented by an orchestra of fifty-two pieces at the Criterion Theatre, where the picture ran for fifteen and a half weeks. Two numbers written by Victor Herbert, "Marion Davies March," and "When Knighthood Was in Flower" waltz, were also given at each performance. The motif of the music changed with the appearance of the various characters and it was always in keeping with the nature of the scene being shown on the screen. This also is nothing new, but the public has no idea of the research work that is done in order to make the "incidental" music correct in atmosphere. A talk on "Music and the Movies" might be given over the radio, explaining how the latest strides in pictorial art now require a tempo and a melody harmonizing with the action of the picture. It seems to me that this is a very interesting element in the presentation of motion pictures. Of course the talk could be followed by the musical score skilfully played.

No class of women in the world, it is probable, have had to learn more about ways to keep physically fit than the motion picture actresses. Studies of diet, of exercise, of ways of keeping their complexions smooth and flawless have been absolutely necessary to their success. Even more than her sister of the speaking stage does it behoove the actress of the silver screen to keep a slim, graceful figure.

"RADIO may in time bring opera companies to the smaller cities such as Troy, Trenton and Columbus that now hear only occasional recitals"

An Interview With

Titta Ruffo

(Metropolitan Opera Star)

By Paul S. Gautier

A photograph of Christy's sketch of Titta Ruffo, especially autographed for his interviewer

TITTA RUFFO has sung twice for the radio telephone—once, in Kansas City—once, in Brooklyn, N. Y., for the U. S. Navy station there, NAH. There must be something extraordinary about radio that such a singer should consent to sing for it, I reasoned. Ruffo is one of the famous tenors, a star of the first magnitude, one of the principals of the Metropolitan Opera Company in New York. So I called upon him at his studio.

"Why did you sing for the radio telephone?"

I put the question to him point blank.

"Ah," he said, "excuse please, I no speak English good," and turning to his manager, Howard Shelley, continued in Italian.

Opera Work Is Hard

That may surprise many people, for Ruffo has been singing in America for a good many years. He has lived among us long enough to learn the language, surely. Yet not so. For if there are any hard working persons in America they are the opera singers.

Work, work, work. Work to learn parts. Work to keep the voice in condition. Work to keep the health absolutely perfect. Spare time there is little or none. Teachers, coaches, pianists, orchestra conductors, managers, all must speak the language of the singer, who is surrounded continually by those who speak only the native tongue. There is no time to bother with another language, no time to learn it. In speaking English imperfectly, Ruffo is like most of the other principals of the Metropolitan Opera, only a few of whom speak the language easily.

So when Ruffo spoke, it was in Italian—such Italian! Soft, fluent, as it is a delight to hear. And I, who understood a few words here and there, was charmed.

"There are only four or five *grande voce*," he said, "such voices as you need to have for the radio. There was only one Caruso, of course. I know that for most people the only way of hearing these voices is by radio, for they cannot go to the opera houses of the world. And so I sang for the radio—oh, no, I sang not for the radio, but for the people, my friends.

"You understand that I have sung in all the countries of the world, except Japan, China and India. I have no need of *réclame*. Titta Ruffo is known nearly everywhere.

"The radio is a great thing for singers who are good and who are struggling to become known. It is a marvelous way for them to get a hearing before hundreds of people at one time. Maybe if I had had radio to help me I would have made my success sooner. I do not know. But now I do not need radio to help me that way."

"Tell me how you came to sing in Kansas City," I suggested.

"Ah, yes, Kansas City. I sing for just one or two reasons," he explained. "Everyone works for money, no? Well, I sing for money. That is work too, very hard work. People do not know how hard. *Secondo*, I sing for sentiment. I sing by radio for sentiment.

"In Kansas City I know the owner of the Kansas City *Star*. He has been very good to me, and when I was there on a concert tour he told me that he was going to open a new radio station, and asked me if I would honor it by singing. What could I do? I sang, of course. Anyone would do as much for a friend. Ah, yes."

"Then you must have a friend in Brooklyn, too," I said with a smile.

Singing for Sentiment

"Brooklyn, that is different. I sang there for sentiment also, but it was different. I like the navy. I like the American sailors and soldiers. Once, during the war, when I came back from Italy on a transport full of American troops, I sang for them, and I was glad to do it; because I like them so much, and they like me, too.

"Also, I have met Rear Admiral Plunkett, commander of the Brooklyn Navy Yard. It was he who asked me to sing for the boys in the navy when he opened his radio station for broadcasting. And of course I sang for those boys in the navy, and in the army, and if a lot of other people, the sick, the blind, the crippled, heard me too, why that is so much the better. And so again you see I sing for sentiment. I got a lot of letters from everywhere from those two performances by radio. Letters from all over the country, because the Kansas City station is heard on the Pacific Coast, and the Navy Yard on the Atlantic Coast. So you see I have sung by radio for the whole United States, in only two performances. That is better than the opera, eh?"

"It certainly is," I observed, "and I should think that radio would do a great deal for opera and for music in general if more artists like yourself would sing for it."

More and More Opera

Ruffo shrugged his shoulders. "I do not know," he confessed. "Maybe so. But what good would it do, when all the opera houses all over the world are crowded every night. Look at the Metropolitan here in New York—sold out every night! What would be the good of advertising it when already there isn't room for everybody who wants to get in?"

"Yes, but if there were enough more people wanting it," I prophesied, "another opera company would be organized."

"Ah," Ruffo exploded as an idea struck him. "You know that in Europe every small city has it own municipal opera company. That is why musical taste is much better there than it is here. Perhaps radio in time may bring opera companies to such cities as Troy, New York, and Trenton, New Jersey, and Columbus, Ohio, where now I only give a single recital once in a very long time.

"Yes, that would be good."

"JUST because you cannot see by radio, but can only hear, is a good thing for the stage, because people are curious and want to see what they have missed"

Said

Lillebil Ibsen

(Granddaughter-in-law of Henrik Ibsen)

to T. J. Dunham

Lillebil Ibsen in Anitra's costume. The music is the theme of the dance, not part of the dress!

"ISN'T it true," said Madame Ibsen, "that broadcasting will help the art of dancing? I mean that if a play with dancing in it, like 'Peer Gynt,' were to be heard by everybody by radio, they would hear all the words and songs, but when I danced they would only hear the beautiful music. Then they would think that if the music is so beautiful, the dancing also must be and then maybe they will come to the theater to see me dance to that music. Do you not think that that is so?

"Just because you cannot see, because you can only hear by radio, is a very good thing, because people, when they miss something are curious and want to see it all. Then maybe some day, also, we will see by radio, and I hope I will live that long, and will see by radio myself, and maybe if then I am dancing still, I will dance for the radio. That will be nice. I hope I live that long.

Memories of Ibsen

"Oh, yes, I remember the famous Ibsen, but I was only a little girl when I met him and I played with his bear rug on the floor. He was a great man. That was long before I was engaged, even, to Tancred. My father knew Ibsen very well, as he managed the National Theater in Christiana, Ibsen's theater, and played Peer Gynt himself. So you see I have been, you might say, connected with Ibsen all my life. When my little son was a baby everybody said that he looked so much like his great grandfather, Henrik, but now that he is two years old I think he is a very beautiful little boy who looks like himself."

Who is Madame Ibsen? She is the granddaughter-in-law of the famous Henrik Ibsen, the Norwegian playwright, having married his grandson, Tancred. She also is a dancer who is famous throughout Europe. Her voice with its slight foreign accent was heard by radio only a few days after her arrival in this country, and since then New Yorkers have had the opportunity to admire her art. She is dancing in the part of Anitra in "Peer Gynt," the famous Norwegian play by Ibsen, with music by another countryman of hers, Grieg.

Probably every radio fan knows the Peer Gynt Suite, by Grieg. Certainly it has been played in every broadcasting studio, either from records or by piano or orchestra. No classical composition is better known to the general public—and Anitra's Dance, being the gayest and most charming section of it, is especially popular.

So there is the unique combination, presented in this country for the first time; Norwegian music for a Norwegian play, the most popular number danced by a Norwegian artist who is herself a kinswoman, by marriage, of the distinguished playwright. No wonder that she was asked to speak to the radio audience on her arrival here, and no wonder that we sought her out for a personal interview.

It was at a dress rehearsal of "Peer Gynt" that she gave us a few moments. We sat in the empty and darkened house while the stage manager watched the doings on the stage with a critical eye.

"Yes," said Madame Ibsen, "I like America very much, and I hope I will stay here a long time, if you like my dancing. No, I do not care that it is dry. It is dry by us, and I think the water is best for a dancer, too."

Lillebil a Nickname

In Europe she is known by her childhood nickname of "Lillebil," and in her appearances there she usually is billed as just that: Lillebil. She has danced in Copenhagen, Stockholm, London, in Paris, in nearly every theater and opera house of importance. In Berlin she created the part of Sumurun in Max Reinhardt's pre-war pantomime of that name, which proved as much of a success here as it did abroad. It must not be thought that she is only a dancer, for she has taken speaking parts too, as in Scaramouche.

In fact, Madame Ibsen is a well-rounded actress, who can tell her story in action as well as voice. There she has a big advantage over the average American star who has gone through training in which the voice was the primary thing, and pantomine only, in the slang of the stage, "business."

And now a little secret. Perhaps this is the great big reason why she wishes to stay long in America; her husband, Tancred, is a Norwegian army officer who has been given two years' leave of absence to study American military methods, at West Point. So we can expect that she will dance for American audiences for at least two years and can join her in the hope that they will like her work and thus permit her to stay.

TANCRED IBSEN

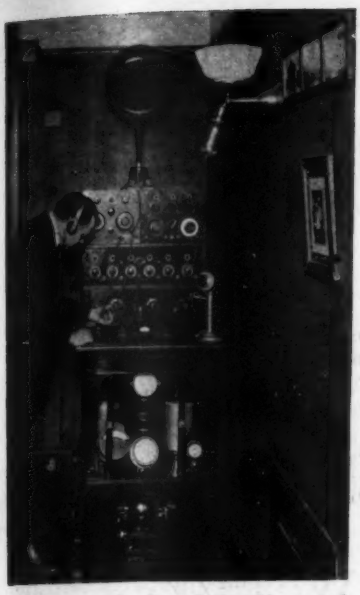
Tancred Ibsen spoke via radio, as well as his wife, and he said: "I have been asked to speak about my grandfather, Henrik Ibsen, but what is of interest about him you can read in all the books, and I am so tired of always being the grandchild." As the radio audience guessed at once, he is a "regular fellow." He is a cavalry officer and an aviator in the Norwegian Army, and is frank in saying that the military methods of his country need a great deal of American "pep." After he has finished his studies here he hopes to play a part in bringing the army of Norway up to date.

The Ibsens first met America miles at sea—by radio. The voice of broadcasting reached them several days before they landed, and they were invited into the wireless cabin to listen to American programs, which, as the Chief Officer said, had "come all the way out here to meet you."

Where Doctors Prescribe Radio

Physicians in Hackensack, N. J., Insist on Patients Listening In—Find Broadcasting of Much Mental Benefit

By Sam Loomis



Dr. DeBaun tunes in. Beneath the table are various parts of a transmitter that may be in operation some day

HACKENSACK is a small New Jersey town—and not so small at that. It's an average American city, with some 18,000 citizens, many of whom commute to business in New York, Newark and nearby centers. It is far enough from Broadway to have a definite individuality of its own, and an unmistakable civic consciousness, yet it is near enough to have within its grasp most of the advantages of the big city at the price of a ride in the train—or the installation of a radio receiving set.

And Hackensack—which, like New York was founded by Dutch settlers—is eagerly grasping the advantages of radio. Antennas stretch in every direction, over lawn and garden, from housetop to garage or tree or pole. In that, Hackensack is not at all extraordinary. Thousands of communities are just as well provided with sets. What puts the city in a little niche all its own is the fact that its doctors have been responsible for the installation of a great many of the sets that are bringing so much pleasure and profit to its residents.

Hackensack doctors, as a body, are enthusiastic over radio. Anybody might guess it from a walk around town, for when you see a doctor's sign you only have to look in the air to find an antenna. That's not 100 per cent. perfect—nothing ever is—but you will find the antenna nine times out of ten, and if there is any town that can show a better average among its doctors, it still has to be discovered.

But you have to call upon those doctors to get the really astounding facts about radio as seen from a medical point of view in Hackensack. You will find them all enthusiastic—and all saying the same thing, whether they be homœopath, allopath, chiropractor, eclectic—even the dentists agree with the rest.

This is what they say, in substance: "Radio is of great value for the sick, especially in stubborn, chronic cases. Its interesting programs and the vital healthy way in which they are given have a highly beneficial effect on patients, to whom they suggest health, taking their minds off the diseases with which they are burdened."

Of course each one has his own individual group of cases, his own method of applying radio in his practice. Each one is cautious about classifying radio as a therapeutic agent, as having positive curative properties, for the ethics of the profession are strict. Each will, however, make it plain that he is not only enjoying it himself, but is recommending it to those of his patients who can benefit by it.

Take Dr. Geo. Wm. Finke, for instance. He has a receiving set of his own, which he has had for over a year. Chronic invalids and convalescents to the number of "about twenty" have installed receivers at his suggestion. He also endeavored to have the new Hackensack hospital equipped with receiving apparatus, but found the funds too low.

In his own life, radio takes comparatively little part. He is a busy doctor, and what that means only doctors and their families ever can know. So, Mrs. Finke listens in more than her husband does. She especially likes the operas, concerts and banquets—and the boxing matches: "If you weren't a radio fan they certainly would make you one."

But in the Finke household radio has a unique place—that of entertainer of the hired man. It keeps him indoors, and happy. Hackensack is a hard place for help; it is too easy to go to New York and get a job, too hard to go there only occasionally for the excitement of a visit. So Mrs. Finke and the doctor both thank radio for keeping their man with them, entirely contented.

Again, take Dr. Essertier—he has a general practice, like the others, but is particularly successful with children. So it has happened that many Hackensack children owe their radio sets to his suggestion. His own set is an interesting one. It was made by P. Stanley Case, brother of the famous Anna Case, the opera singer, and is such a good job that the doctor was asked to exhibit it last year at the New York radio show. He preferred to keep it in use at home, however, and the photograph taken especially for THE WIRELESS AGE represents its first public appearance. Mr. Case did not make the cabinet; that was a labor of love by a "G. P.," or Grateful Patient.

Dr. H. C. DeBaun, D.C., has reversed this procedure, and has himself made no less than 28 receiving sets for patients. He is not only a chiropractor, but an expert in electrical matters, and has a great array of X-ray apparatus. In fact, he does so much work with X-rays that for a time he was rather heartily disliked by Hackensack radio fans. Every time he would start up the biggest of his five machines the high-frequency coil that is an essential part of it would raise such a racket in the town's receiving sets as to drown out everything else.

That would never do, and so the doctor set about remedying the condition. The cure turned out to be simple. It consisted of a heavy, insulated wire run from one pole of the starting switch to the ground. Since the connection of that wire there has been no interference with reception; even the receiving set in the hall, not ten feet from the machine, picks up not even a buzz from it. And that machine is rated at 20 kilowatts and normally consumes from 15 to 18 kw. This is a tip for others who may be harassed with the same trouble, hospitals, for instance, that wish to install radio receiving apparatus, or that want to prevent their electrical machines from interfering with neighboring radio sets.

Dr. DeBaun, in fact, is full of kinks. For attaching a single phone to a horn he uses one of those big rubber nursing bottle nipples, putting the phone in the big end of the nipple and cutting off enough of the small one to allow it to be slipped over the end of the horn. Then there is his organ pipe loud speaker; simplicity itself. It consists of an old wooden organ pipe, about four inches square and four feet long. Once upon a time it sounded in a church organ. When it was

scrapped, the doctor rescued it from the junk dealer, and now it resounds with radio programs, standing upright over a single Baldwin phone.

In fact, Dr. DeBaun is so enthusiastic and so expert that he and Dr. Haggerty have joined eleven other radio enthusiasts in the formation of the Hackensack Radio Laboratory. A 200-watt radio telephone transmitter is to be installed, with the thought that perhaps programs will be broadcast on special occasions. Primarily, however, the Laboratory has been formed for carrying on certain experimental work along lines that have been suggested by the members, all of whom are men who have had considerable radio experience.

Dr. Haggerty is a dentist, a lawyer, an electrical engineer, and has been a radio enthusiast for ten years. The men who have formed the Laboratory, other than the doctors, are: Judson Hayward, W. K. Sparrow, M. R. Sneeden, M. F. Sneeden, Percy Temlett, Stanley Russell, W. H. Ricardo, M. Damrau, M. D. Campbell, H. N. Davison and A. Eckleston.

The group of Hackensack doctors who are enthusiastic over radio includes Dr. Conrad, the dentist, and Dr. Gilady. The latter says that radio is "greatly appreciated by a host of medical men in our community."

So it is indeed, and it is a great and significant compliment to radio that such is the case.

Steinmetz Ridicules Fire Risk

THAT radio receiving equipment contains no fire hazard is the opinion of Dr. Charles P. Steinmetz, of the General Electric Co. He was asked by an amateur as to the fire danger involved in a receiving set, and made the following reply:

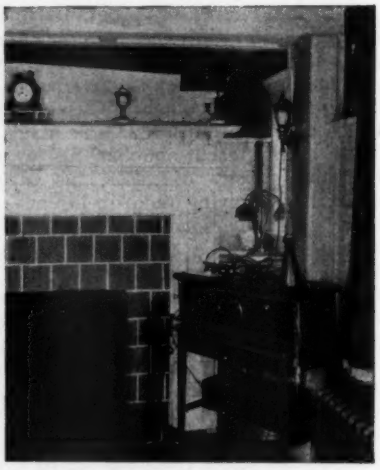
"There is no hazard in the amateur radio receiving station. It involves no fire risk, nor risk to life. It would, therefore, be very regrettable if, by a misguided public opinion, obstructions were placed in the way of the fullest and freest developments of the amateur radio station.

"With regard to the possible lightning risk from the grounded antenna, first—the lightning risk in a city is very remote in any case and, second—the grounded antenna rather acts like a lightning rod and exercises a protective action against lightning.

"Any danger from the radio power received by the amateur station obviously is ridiculous when considering that the energy of a single pound of coal would be more than enough to operate the radio receiving station continuously for over a thousand years. Certainly this is not enough energy to do harm."

Broadcasting Completes Trade Report System

THE latest business use of radio in the United States consists of the broadcasting of foreign trade opportunities by the radio telephone. This makes the radio chain complete from the transmitter in the foreign country to the American business man sitting in his home or office. Trans-Atlantic radio facilities are used by foreign agents of the Department of Commerce when speed is necessary. Heretofore, such trade information has been published in a daily bulletin, necessitating considerable delay. Now, however, the bulletins are furnished immediately to all broadcasting stations that desire to transmit them, so that it is quite possible for business men to hear in the evening an important trade tip that may have been discovered only that morning by a government agent in Europe.



Dr. Essertier's receiver has the fireside nook of honor, and fills it well

Broadcasting of these foreign trade opportunities was started as an experiment by WGI, at Medford Hillside, Mass., which is heard throughout New England. On the morning after the first transmission of trade information several letters were received from nearby firms. One of the leading New England manufacturers of artificial leather who happened to be "listening in" that night learned of two possible openings for his goods; one in Mexico and the other in Colombia. He was much pleased, commending the Department of Commerce for taking advantage of "this most valuable time saving device." In the opinion of another New England merchant, the new "sell-it-by-air" service should appeal particularly to the out-of-town manufacturers and merchants who are not in daily contact with the offices maintained by the Commerce Department in Boston, New York, San Francisco, Chicago, New Orleans and other leading cities. "For example," says this executive, "there are many manufacturers interested in radio who wish to sell abroad, but who are prevented from keeping in constant touch by frequent visits and telephone calls with the trade openings reported to the government agents. As the radio stations reach many outlying cities it would seem that this service should be of especial value to more distantly situated business men within a wide radius."

The instantaneous success of the plan in New England quickly interested other broadcasters, and it is expected that in a few weeks each of the 34 branch offices of the Bureau of Foreign and Domestic Commerce will have made arrangements for regular broadcasting of important bulletins.

"Music in the Air"

WITH the trip of a commercial passenger airplane from Geneva to Paris, reads a copyrighted cable dispatch from Paris to the New York *Times*, wireless concerts for air passengers have become an assured fact. The experiment, which had been tried on the Paris-London route with only passable results, is now wholly successful and satisfactory.

"By a coincidence, ten of the fourteen passengers who enjoyed the concert were Americans. The music was sent out by the station at Lausanne and was heard plainly until the machine struck rain some distance beyond Dijon. From that point, however, conversation was held with le Bourget.

"Receivers were passed to each occupant, the pilot finally taking them and chanting to the passengers the songs received.

"This success is believed to assure the general inauguration of facilities for receiving concerts on all passenger airplanes.

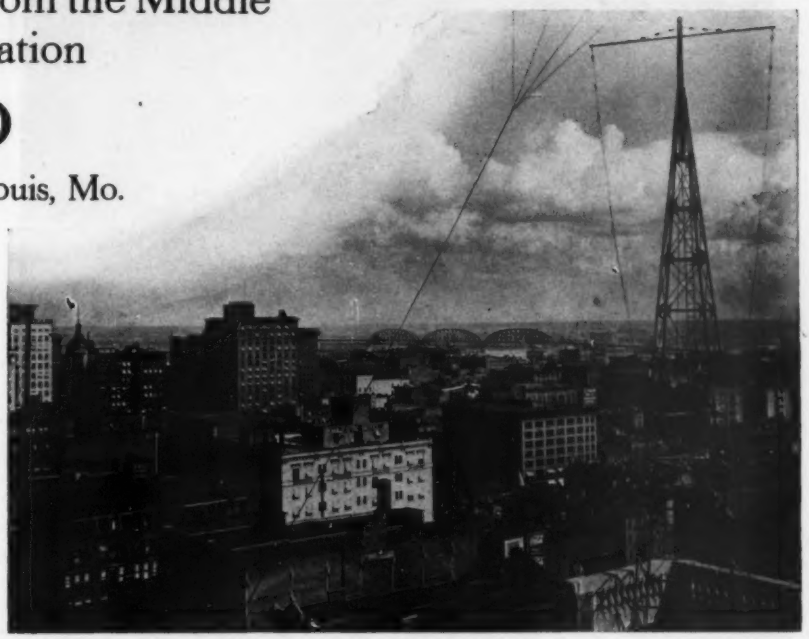
"A member of the Temps staff has suggested to various wireless stations that they supplement the scenes of their districts by appropriate selections such as Swiss mountaineer songs and 'William Tell' for Lausanne, 'Mireille' for Provence.

"Interesting experiments have been carried out during the last few days on the Paris-Orleans Railroad by which engineers receive wireless communications. A receiving post having been rigged up where there is an electric light installation and the car being used as antennae, they are able to intercept messages from the new French station at Saint Assise. The result is declared to be very satisfactory and wireless engineers state that by means of special antennae attached to the roof of a car it will be possible to receive wireless telephone messages without difficulty."

Talking Both Ways From the Middle Through Station

KSD

Located at St. Louis, Mo.



This is both KSD and St. Louis, one and inseparable. The antenna on the roof of the "Post-Dispatch" building probably makes itself known to more people than the famous bridge over the Mississippi, seen in the background, ever did

IF you were going to erect a broadcasting station that should be heard on the Atlantic and Pacific Coasts, on the Gulf and in Canada, and on the ships that sail the seas to the East and West and South, in other words if you wanted to put up a broadcasting station that would be heard throughout the United States and across its boundaries, where would you put it?

Would it be New York? No, for there nearly one-half of the power of the transmitter would be projected over the sea.

Would it be in Chicago? No, for there a large portion of the power would go into the vast open spaces of Canada.

It would have to be in a truly central spot within the territory of the United States. If you will look at the map and think of the cities in the central section you will quickly realize that St. Louis, Mo., is about the largest city in the center of the country. That is one outstanding reason why station KSD can boast proudly and truthfully that it is heard in all forty-eight states of the Union and by ships on the Atlantic and Pacific Coasts. As a matter of fact, it is not exactly in the center, being a little east of the true geographical focus of the country, but nevertheless so successful has been the working out of the transmitter that it is heard on the Pacific Ocean with practically the same power as on the Atlantic.

"This is station KSD, the St. Louis 'Post-Dispatch,' St. Louis, Mo.," comes with a welcome sound to hundreds of thousands of ears nightly, from 8 p. m. onward, on 400 meters. In fact, it is another of the "Post-Dispatch's" boasts that it was the first to be authorized to transmit on the Class B wave length of 400 meters.

The programs that are put on have varied from one-man talks in the studio, to the transmission of opera performances from the stage of the Municipal Theatre in Forest Park, with the voices of a chorus of several hundred going forth into the ether. The station has now been in operation for over a year.

It started with a little 15-watt transmitter, really nothing more than an amateur radiophone, and in fact, not as good as many that are to be found in the hands of amateurs all over the country. However, this diminutive set showed so much promise that a larger one was secured, of 500 watts power and as soon as the new Class B was open, application was made to enjoy its privileges.

Let us visit KSD. One leaves the elevator in the "Post-Dispatch" Building and steps into the reception room, where those who are to take part in the program await the call that summons them into the studio. It is a room the like of which cannot be found anywhere else in St. Louis. Summer and winter it looks as though it had been sheathed in tailor-made garments —and as a matter of fact it has. Every musical instrument and every bit of furniture has been covered with soft cloth, including chairs, radiators, the piano bench and even the adjustable pedestal for the microphone. Not an inch of bare wood is to be seen and so there are no smooth surfaces from which sound waves may echo. The walls are hung with thick fabric and there are two layers of felt under the heavy carpet. The voice, and the sounds of musical instruments fall upon the air of this room and upon the microphone without any accompanying reverberations.

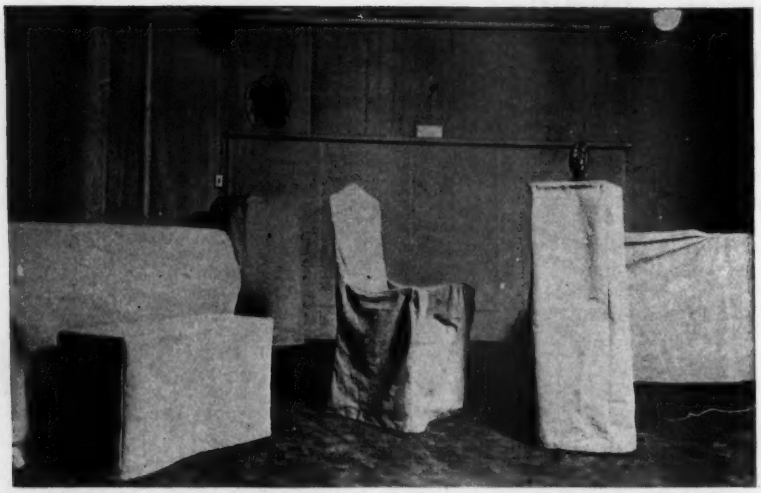
The first thing that will attract attention in the KSD studio will be a red light, and then another and another and another. There are four of them, one on each wall, so that they cannot be overlooked. Under each one is a warning stating:

> "When the red light is burning any sound of any kind in this studio goes out broadcast by radio."

As the artist goes into the studio these red lights are out and the program director after a few words of instruction, touches a button that flashes a signal to the radio operator on the roof, advising him that all is ready in the studio. As the operator completes the circuit between the microphone and the transmitter the red lights go on. The announcer tells the audience of many thousands who are listening in, what the next feature on the program is to be and then the entertainer proceeds. At the end of the selection another button is pressed, the transmitter turned off, the red lights go out and once more the studio is free for conversation of a business instead of a radio character.

Power for the transmitter is furnished by a motor-generator set, consisting of a five-horsepower motor driving two generators. One generator produces 1,600 volts for the plates of the 250-watt power tubes, of which there are four. The other generator turns out 16 volts, to light the filaments in the tubes.

Current to operate the microphone in the studio is supplied by an 18-volt storage battery. From the microphone the electrical modulations caused by the sounds in the studio go through an amplifier, which is supplied from the



Summer and winter the studio of KSD looks like this. It's its anti-echo, reverberation-proof dress, and it does its duty well

same 18-volt storage battery for filaments while dry batteries give a pressure of 130 volts for the plates of this amplifier. From the voice amplifier, the electrical currents that correspond to the music that is being produced in the studio go to the modulator tubes, which control the output of the oscillator tubes that are connected with the antenna and so with the ether and with the radio set of the listener. In this arrangement the set is similar to that of hundreds of others operating in all parts of the United States.

The antenna consists of four phosphor bronze wires spaced six feet apart, and 130 feet long, swung between two 70-foot steel towers, or rather from wooden masts 10 feet long, set on the tops of the towers. The lead-in is taken from the center of the antenna which thus is of the T type.

Station KSD is not only being heard all over the United States, but also is being heard regularly in the Aleutian Islands, the most westerly territory of the United States off the Continent of North America. The air-line distance is about 4,000 miles. The broadcasting programs are heard by station KWS, located at the Alaska Sulphur Company's mine at Akun Island, using a detector and one step of audio-frequency amplification. There are sixty men and one woman on the island with radio as the sole source of communication with the rest of the world except for the monthly visits of the mail boat. The entire personnel of the island listens in regularly.

Communications and Banking

FEW people realize the vital part played by communication systems in the business life and prosperity of the world. That was made plain on February 24, when General James G. Harbord, President of the Radio Corporation of America, addressed the Bankers' Club in Chicago. General Harbord's address was a scholarly survey of the development of communication through the ages, with pertinent historical facts as to the ways in which the great bankers of the Europe of the Middle Ages and later times, laid their own private communication lines. It is a historical fact that the great Rothschild fortune was founded by a system of special couriers, giving that house exclusive advance information that it was able to turn to speculative advantage. The final feat that placed the Rothschild fortune at a tremendous figure was that of Nathan Rothschild, who personally watched the Battle of Waterloo until he saw that victory would come to the English, hastened to London and bought securities secretly while the market was still panicky with fears of a defeat.

The contrast of this with today is, of course, striking, for now the cables and radio give communication with all parts of the globe, frequently in fewer minutes than it formerly took days. The result, General Harbord pointed out, has been a stabilization of trade, banking and industry, in which everybody benefits directly or indirectly.

French Pilots Use Radio

WIRELESS telegraph posts have been established by the French Government at Rouen, at the mouth of the Seine, and wireless sets likewise have been placed on the French pilot boats operating on the river. By means of these sets prompt reports will be given of all shipping entering and leaving the river, and docking will be accomplished without delay. Three pilot boats have been fitted with continuous wave sets, operating on 520 meters.

WOR Is Heard in England, France and Germany

STATION WOR at Newark, N. J., has been heard on the air late at night a number of times in attempts to carry its program across the Atlantic to England. Strangely enough, though that excellent station has been heard over a wide area of the United States, and occasionally in Europe, it remained for the special test on February 23 to be the first conducted by that station to be heard more than fragmentarily. The triumph was decisive, WOR being heard not only in England, but in Europe generally. Many Englishmen listened to the entire concert; the program was heard in France and was reported in its entirety from Lichterfelde, a suburb of Berlin, Germany.

The report of reception from the interior of Germany is especially notable, as this is the first confirmed evidence that American broadcasting has been heard in that country, though WJZ was heard once upon a ship in Bremerhaven.

Miss Edith Bennett, whose voice was heard all over Europe the night of WOR's spectacularly successful trans-Atlantic test

The London correspondent of THE WIRELESS AGE reports the Bamberger test as follows:

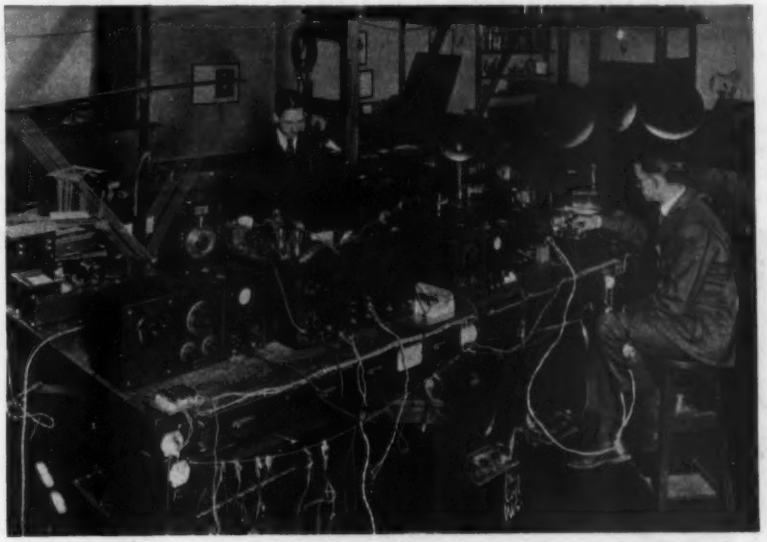
"Bamberger transmission received by Inman Hampstead London weak until 6 entire until 6.13 one radio detector one audio, two others in London also received program satisfactorily."

The program was broadcast at midnight, eastern standard time, on February 23, and consisted of announcements, and songs in Italian, English and French by Miss Edith Bennett. It was enjoyed by radio fans in nearly all the states, as well as by their European cousins.

Where Your Receivers Come From

Unheralded Work of the Radio Laboratory Essential to Production of Good Sets for Amateur and Professional Use on Ship and Shore

By Ward Seeley



Just one radio laboratory table, groaning under its weight of receivers being tested

WHERE did your receiving set come from? You bought it in a store, you say? Oh, no! The store got it from the manufacturer, the maker got it from his factory and the factory got it from the laboratory in the form of a tested and approved device. That set was first a vision in the minds of a few men, then it was a hopeful experiment on a laboratory table, and then it was a successful experiment on the same table. That is where your set came from.

You got it from a laboratory. In fact, nearly everything you have has gone through some laboratory or other at some time in its history—clothing, many foods, electricity, paper, books, automobiles, furniture, china, the coins in your pocket, the medicine you take and the soap you wash with, even the glue that you lick on the back of the postage stamp.

There are two main functions performed by a laboratory that is maintained by a commercial organization—regardless of the line of activity, whether it be chemicals, textiles, automobiles, or radio. One function is in the development of new methods, new apparatus, new principles; the maintaining of progress in a steady march ahead. The other is the maintenance of quality in all activities that have proceeded out of the laboratory and have become commercial rather than experimental practice.

It is hard to say which of these functions is the more important. The one comes before the other, it is true, yet without the second, it would be difficult, if not impossible, to assure that the benefits of the first would be realized by the public.

For the general public has a great interest in what goes on in secret behind the locked doors of the experimental laboratories. There is not a receiving set on the market whose history has not at one time or another included a visit, usually a prolonged one, with the engineers. The very sets that are giving so much pleasure and profit today to the hundreds of thousands of broadcast listeners did not spring into being over night, nor were they hastily "slung together" to fill the demands of opportunist salesmen, nor were they the creatures of happy chance.

No, the receiving sets that are giving the most pleasure in the home today are carefully worked out evolutions, in which every item has had the scrutiny of the specialist, usually of several specialists. Before they get into production weeks and months must be consumed in theory and calculation, experiment and test. The first tool that is put to work frequently is the slide rule, or "slip stick," as the engineers call it, by which intricate mathematical calculations can be done semi-automatically.

Astounding, you say? But are not the results also astonishing?

Take the laboratory of the Radio Corporation of America, for instance.

Dr. Alfred N. Goldsmith at work

Every time you file a Radiogram for Europe or Asia or for a ship at sea, your message goes through many different pieces of apparatus, all either in whole or in part products of the laboratory. Even today a vast amount of research work is being carried on in the interest of the people who wish speedy and reliable communication by radio telegraph. The present maximum speed by radio is around 120 words a minute, by automatic devices; speeds ten times greater are being worked out to practicality by the RCA laboratory. When they come, the business world will find at its call ten times the present facilities for the exchange of messages by radio.

Every time you turn a knob on a receiver you alter the characteristics of the circuit in exactly the manner that the engineers have determined. The thought has been built into it by others—you have only to turn the knobs until you get the results you want. It is like the old Kodak slogan: "You press the button, we do the rest," and as in the case of the Kodak, the performance of the "rest" has been guaranteed for the amateur by much previous work on the part of the professional.

Now it should not be considered that expert technical skill and advanced scientific knowledge are all that is necessary in a laboratory—are the sole essentials to the successful use of technical ability. There is another element, and it comes mighty close to being the vital spark.

It is called by various names. "Imagination" is one of the best, "In-

spiration" is not quite so good, "Vision" is perhaps best of all.

Broadcasting was just an imagined vision only a few years ago. "Can it be done?" was the query. "It can," was the answer, and in asking the question and in finding the answer three types of thinkers at least have collaborated. One, the man who knows nothing of practical difficulties and limitations, and only wants to secure a result, he knows not how. He is usually a business man. Two, the scientist who eagerly seizes the opportunity, realizes both the great scope offered and the tremendous difficulties, and sets himself to work out the major lines of attack, along some of which success may be met. Three, the skilled technician, the engineer of originality and resource, who may be relied upon to work out a problem once its conditions have been laid before him.

Messrs. Shapiro and Ringel of the RCA Research Department working on an extremely selective high speed receiver capable of recording 1,200 words a minute

Sometimes all three men are to be found rolled together into one. But as Dr. Alfred N. Goldsmith, Director of the Research Department of the Radio Corporation, said recently at a dinner, most frequently it is the technically ignorant business man, who doesn't know what can't be done, who starts the engineers off on the accomplishment of the impossible, to their own great astonishment.

That is what a laboratory is for. That is what engineers are for. Here is what we want says the public, in effect, to the manufacturers. Here is what we must have, say the manufacturers to their engineers. Here it is, say the engineers. The public will be served.

In this particular laboratory that we are talking about there has been evolved many new ideas, and the work still rolls merrily on. Take the Radiola IV, for instance, which has sprung into quick favor. About a year ago, Dr. Goldsmith, being himself one of those rare combinations of engineer and business man, decided that the time had come for a receiver of just about that type.

Today, if you are especially favored you will be shown the daddy of the Radiola IV in the laboratory up on a shelf, its work done. It has a mahogany case and excellent appearing controls, and it and the model that sprung out of it no doubt are proud of each other, as they should be.

As you are conducted about the laboratory you see receivers of every conceivable kind scattered about under process of test, of construction, even of design. A few odds and ends of sockets and coils and things, betraying no special thought save to the expert, may represent a new idea. Wires running apparently haphazardly; a fortune in tubes lying around promiscuously; boxes of adapters of all kinds, so that every different kind of tube can be put in operation in any set, in order to determine its advantages and disadvantages; you see the familiar "slip stick" here and there on desks, but the tables groan under the weight of apparatus undergoing tests in actual working conditions, ending conclusively the argument that mathematics only started.

That is the big thing about this laboratory; it is scientific; there are theories galore, but it is also practical. And that is why that which comes out of it is so good. That is why the receivers being manufactured and sold today will be as good tomorrow, and in years to come, as they are now, regardless of what new things may be developed in the future.

Of course new things are coming, things that even the engineers themselves are not sure of, but that does not render the present apparatus any less marvelous. Any man who waits for the radio laboratory to put its O.K. on a piece of apparatus and say that there is nothing further, that the ultimate has been reached, will wait forever.

Loud speakers, for instance, are now to be had in satisfactory volume with excellent quality. Yet the laboratory is not through with them by any means. In fact, the loud speaker, perfect as it now seems, is just in its infancy. There is in the RCA laboratory a special acoustics department, provided with special sound-proof chambers. One of them contains a special oscillator that produces electrical vibrations at all frequencies within the range of audibility. By connecting this to a suitable receiver, which in turn feeds a transmitter connected to an amplifier and measuring instruments, every possible condition of voice and music can be reproduced. By means of a recording device it is possible to measure the response for any given tone. This apparatus tells infallibly all about it.

Another sound-proof chamber contains somewhat similar instruments, but is used for testing pick-up devices, the microphones that are used in the broadcasting studios and the amplifiers. These go through the same kind of tests. The devices at present in use in broadcasting are marvelous in their faithful rendering of notes of widely different pitch, and of different character, yet here are being conducted tests and mathematical studies that may bring perfection one step nearer. The work done in this particular comes close to pure physics, it delights the scientist, yet it holds forth practical promise of increased delight for the world's radio listeners.

These are but a few of the laboratory's activities, by which future progress is assured and present quality maintained.

Some of the radio specialists of the laboratory: Standing—left to right—Messrs. Van Dyck, Weinberger, Dr. Goldsmith, Shapiro and Larsen. Kneeling—Reeber, Miller, Dickey and Ringel

How Radio Helps to Make It the *Majestic*

Famous Ocean Greyhound's Radio Room Hums With Activity 24 Hours a Day—Skilled Operators Can Tell Exciting Tales of Adventures at Sea

A STATELY ocean liner, far out at sea, with a steward hastening along the deck. "Mr. Johnson, Mr. Johnson," he calls. The passenger beckons and is presented with a small envelope bearing the word "Radiogram" printed in red. It is a message from the shore, ticked off into space only a minute or so before, and Mr. Johnson reads it before the sender has hardly had a chance to stop thinking about it.

His reply, scribbled on a blank and handed to the waiting steward, is put on the air in the dots and dashes of the Continental code, and may be in the hands of the addressee on shore within the hour, or sooner. And nobody marvels, for this one-time wonder has become a commonplace.

On board ship, only human fingers and brains operate the radio apparatus. While the immense land stations that transmit from continent to continent may employ automatic methods of sending and receiving, achieving speeds of 100 words a minute and more, the limited space available on board ship so far has prevented the use of this apparatus, and the hand key and the headphone figurative king and queen on the ether, reign supreme—with the consent and guidance of the prime ministers, the radio operators.

On board ship, radio means the radio operator, the chief and his assistants. They are the men who span the waves, reaching from ship to ship, and from ship to shore. Their skill, their intelligence, their faithfulness, annihilate distance, close the gaps between those at sea and ashore, enable active business men to keep in touch

The radio operators of the "Majestic": Chief operator Garwood in the center, Second Officer Jacobs at the right, Third Officer Brunt at the left

with their affairs and direct their course while traveling by sea, and, in an emergency, summon aid, saving life and property.

Radio is a tremendous blessing to those who sail the seas. Today it is within reach of all. It is a real public utility. Its service is comparable in every respect with that of the land telegraph; the same speed and accuracy is now available to the passengers of the great liners of the ocean.

Among the hundreds of ocean-going steamships that offer this indispensable service is the *Majestic*, a White Star Liner, a queen of the seas. A message every minute for five hours without error is only part of a day's work for the radio officers of this huge vessel. Continuous, 24-hour-a-day operation while at sea, sending and receiving messages for the passengers and the officers of the ship, is the rule aboard the *Majestic*, as on many another ocean greyhound.

All these operators are veterans at the game, each having rounded out over twelve years of sea service. Mr. Garwood first went to sea in 1910 after serving as a railroad telegrapher for seven years. Mr. Jacobs, the second officer of the radio staff, sailed the seven seas before entering the English Marconi service in 1902. Egypt, South Africa, India and Australia are familiar haunts to Mr. Jacobs, as they were to the many budding operators of the Marconi Company in the early days of radio telegraphy. He is known as a master instructor in radio theory and practice.

Mr. Brunt made a personal visit to the trenches in France during the war, but he was later inspired to continue in his calling atop the briny breakers; he tells us that he served with the Fifth Battle Squadron of Mystery Ships. He ducked a mass of shells and submarine bullets while engaged as a radio operator on ships sailing the waters in the vicinity of the British Isles during the war.

Consider for a moment the vast amount of traffic the *Majestic's* radio staff handle with the Chatham station of the Radio Corporation of America. On her last voyage thousands of words were received and transmitted in but five days, representing many hundreds of messages and in addition scores of relay messages passed through their hands, bound for small vessels whose radio transmitters are not powerful enough to span the entire sea.

There is a marked contrast between the wireless apparatus on the first radio-equipped vessel, the old *Philadelphia*, and that of the *Majestic's* installation. The transmitting equipment is composed of three independent sets, a 1½ kw. tube set, a quenched spark and an emergency outfit. Commenting on this apparatus, Chief Officer Garwood said, "We handle too much traffic to invite jamming by using our spark transmitter, so the tube set is hardly ever idle." Because of the highly efficient transmitter and receiving apparatus at the Chatham station and the speedy and accurate operating personnel stationed there, the passengers of the *Majestic* are given a remarkable service.

A corner of the operating room on the "Majestic," showing Third Radio Officer Brunt at one of the special receivers, used for direction finding. In the center is the big 1½ kw. continuous wave transmitter, and at the right the ordinary receiving apparatus

The Musician in the Operating Room

By Golda M. Goldman

EVERY visit to a broadcasting station reveals a new person upon whom in some particular and peculiar way depends the success of the broadcast program. At first it appears that only the artist is responsible for the pleasures which transport the listener-in. Then it develops that Mr. Announcer has duties extremely more complex than the audience might be led to expect from his simple statements into the microphone. After several visits to the very successful broadcasting studio of Station WEAF at Walker Street, New York City, I began to realize that everyone around a studio must know something of music, everyone must be socially inclined, everyone must be able to fill in when promised talent develops bronchitis at the last moment.

But a surprise was really in store for me when I visited the operating room and watched the engineer "monitoring" the transmission, for I found that even the men whom we think of as connected only with the mechanical process of transmission have it in their power to either make or mar a program. So true is this that it is found necessary to give musical instruction to the men in charge of the operating room.

The entertainer in the studio sings or plays into the microphone and the current controlled by it is carried along a wire to the transmitter, which may be at a considerable distance. Before it reaches the transmitter, however, the current is tapped at the input power board, where an amplifier reveals how the sound is carrying. The engineer in charge of the panel has under his hand the power to control the mean average current input to the wire line.

Now here is where, as I said above, it is possible for this engineer to make or mar a program by increasing or decreasing the power so greatly as to obliterate all technical and emotional variations from any performance. For instance, a pianist rendering a complicated composition may at one moment play ever so softly. The radio audience, because of the buzzing of wires, static, or other disturbances, may almost or entirely lose this portion of the selection which would be perfectly audible to an audience in the room with the performer. By judiciously increasing the current, the operator overcomes these disturbances and the listener-in enjoys the same results as does the visible audience. Immediately after the pianissimo portion of his selection, the pianist crashes into a fortissimo movement, which comes smoothly and agreeably to those in the studio with him, but which causes the receivers to jangle, doing them some degree of harm, and leaving a harsh and unmusical impression upon the auditory nerves of the listeners-in. Again, by a wise decreasing of the current, the engineer allows the change in movement to reach the unseen audience in a harmonious fashion.

Now it is obvious that had the engineer no appreciation of technique, no ear for music, in obviating extremes he might easily cause to be transmitted an evenly ironed out and entirely emotionless interpretation, and so ruin the work of the very finest artists. It is equally true, of course, that without his manipulation of the current the program would still be received, but the point is that without him it would be a program most of whose delicate timbre and tone would be lost in the transmission, while with him all the charm of the studio is preserved. Naturally, the operator does not exercise this control continually, from moment to moment, but changes are made from time to time as necessitated by the varying character of the program, and the skill with which each change is made is one of the things that makes the difference between merely good and really excellent results in any broadcasting station.

The musicians in the operating room—radio experts, they have much to do with the quality of the broadcast wave and therefore of the music that it carries

German Opera Heard in Germany

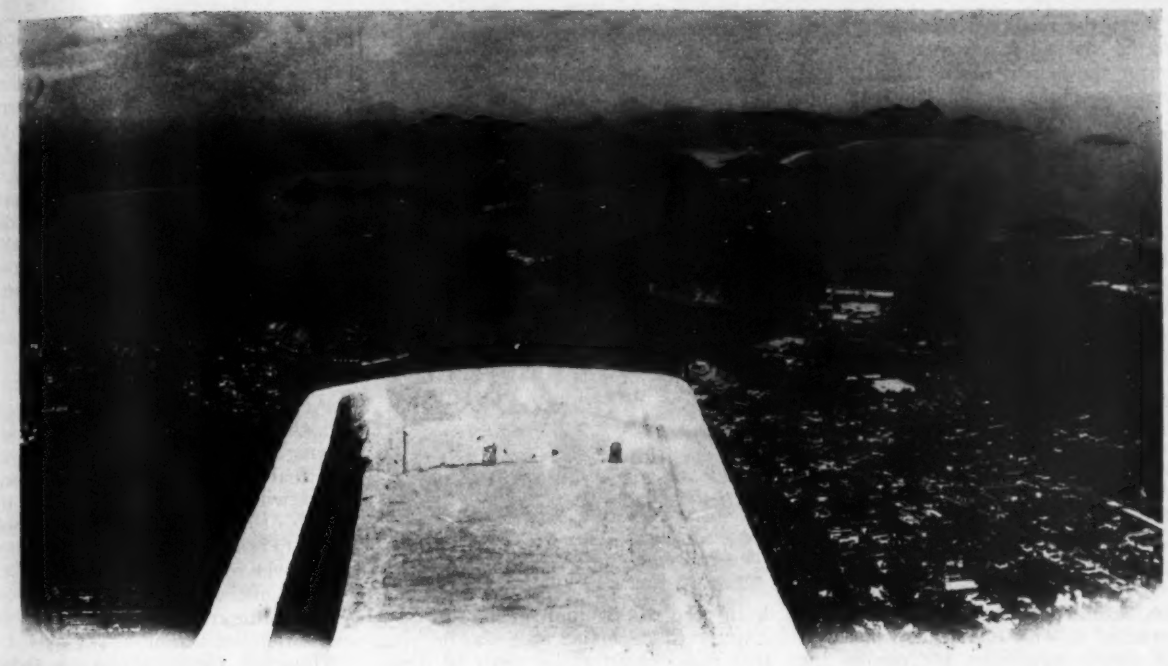
"CARRYING coals to Newcastle" —WJZ has been guilty of that, as witness this radiogram: "Signals strong 0400 Greenwich mean time February 21, Bremerhaven, Germany, Manhattan Opera A.J.N. announcing. Radio KDCL." KDCL is the call of the S.S. *George Washington*, which sails between New York and Germany. On February 21, WJZ transmitted the German opera "Die Walküre," direct from the Manhattan Opera House, and it was that opera that was heard in Germany, the land in which the tale is set, and whose most famous musician, Wagner, wrote the words and music.

WHAZ Heard in New Zealand

WHAZ, the broadcasting station of the Rensselaer Polytechnic Institute, Troy, N. Y., has been reported heard in Invercargil, New Zealand, during a special test that the station conducted late in February. In order to give listeners to the west, in the Pacific Ocean, a chance to endeavor to hear the station, WHAZ ran a series of early morning transmissions, using voice and music. The period of sunrise was chosen, as experience shows that at that time the radio waves frequently are heard at distances much greater than normally. At 6 a.m. on February 28, which was 11 p.m. in New Zealand, WHAZ conducted one of these special tests. A cable from Invercargil the next day reported the station as having been heard clearly on a detector tube with no amplification. The air-line distance is about 9,500 miles, and this represents a record in broadcast reception.

NAA Broadcasts the Weather

THE Arlington naval radio station, NAA, which has been broadcasting by radio telephone on 710 meters for several months, has now begun transmitting weather forecasts and warnings. This weather information is broadcast twice daily, Sundays and holidays included, at 10:05 a.m. and p.m. It is for the following states: New England, New York, Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia, Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Kentucky, West Virginia and Ohio. Special warnings of cold waves, frosts and floods, when available in the afternoon, are broadcast at 3:45 p.m. The announcements are made directly from the office of the U. S. Weather Bureau in Washington, over a telephone line that is connected with the transmitter of NAA at Arlington, Va.



Rio de Janeiro as seen from Mount Corcovado, on which a temporary radio telephone transmitter has been erected

Latin America Listens In

By Geo. W. Gether

BROADCASTING has struck South America, and hit it hard. The southern continent, fond of music, supporter of some of the best opera houses in the world, is seizing eagerly upon the most modern method there is for the distribution of it. More, the enthusiastic Latin-American temperament has been stirred by the romance of the radio telephone, and popular interest in the Argentine, Brazil, and the other countries to the south is at a white heat.

Originally, interest in radio in Latin America was created by amateurs in the Argentine, who were among the first in that part of the world to experiment with the radio telephone. Today it is said that there are in Buenos Aires 250 amateur stations which may be called broadcasters. The situation is somewhat similar to that existing in this country a year ago, except that popular interest is much greater in proportion to the quality of matter being broadcast and the size of the transmitting stations.

The latter two points are being improved, the various companies that own the vital patents covering radio telephone transmission and reception having decided to provide South America with broadcast stations and programs of the best possible type, as well as with apparatus. For this purpose the Radio Corporation of America, the British Marconi company, the French Compagnie Generale de T. S. F., and the German Telefunken company are organizing along "consortium" lines, having decided upon the formation of a company to be known as "Radio Sud-America," in which the four companies will be equal stockholders and sharers of costs and profits. Radio Sud-America will in turn organize such national and local companies in South America as may be necessary to conduct its business of distribution of apparatus and operation of broadcasting stations.

Broadcasting probably will be done by national companies known as "Radio Broadcasting de Brazil," "de Argentino," etc., these being financed by the parent organization. It is indicative of the height of interest in South America that the word "broadcasting" has been adopted into the language. There is no single word in Spanish or Portuguese that is so expressive, and the Latin American has eagerly adopted the term from the country in which it was born.

What will probably be the first broadcasting station to be operated by the consortium is already working in Buenos Aires, where it was erected in October by the Radio Corporation of America. W. H. Howard, one of the company's installation engineers, was sent to Buenos Aires in September, where he took over a 1 kw. transmitter in the warehouse of the International General Electric Co. and proceeded to erect it on the roof of the General Electric office building. Work was started on Monday, October 3, in great haste, as it was desired to have the station in operation by the following Sunday, in order to broadcast the Tracey-Firpo boxing bout. A temporary aerial and counterpoise were erected, and on Thursday night the first tests were made, showing 8 amperes in the antenna. On Friday and Saturday daylight tests were heard in Montevideo and Rosario, in Uruguay and Argentina, at distances of 220 and 300 kilometers, or 120 and 180 miles, respectively.

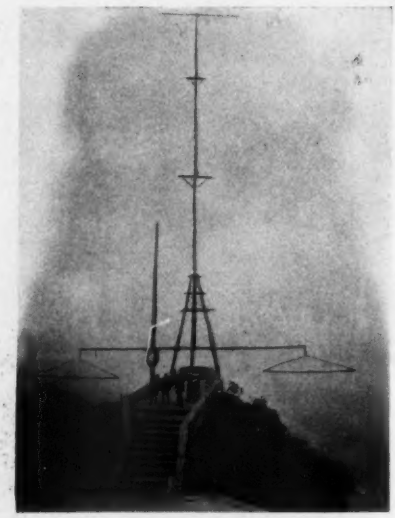
The first actual broadcasting on the part of the new station was on October

7, when the results of the polo match and the baseball scores were put on the air for the benefit of the English and American clubs, which had requested it.

Sunday the 8th was the big day, on account of the heavyweight championship bout. Considerable difficulty was experienced in getting a telephone wire from the ringside, and it was obtained only an hour before the bout started. The match was broadcast blow for blow until the Argentine champion knocked out his opponent. Despite the fact that a local newspaper also had a direct wire to the ringside, the news of the knockout was repeated on the air several times before the newspaper set off the big bomb that it had announced it would explode if the Argentine boxer won. This striking exhibition of American speed roused great enthusiasm in the Argentine. Since then, the station has been given a more permanent installation, several Government officials have inspected it with an idea of purchasing similar apparatus for use by the Argentine Government, and sales of receiving apparatus have taken a perpendicular jump. The Argentine has welcomed professional broadcasting with the enthusiasm that only Latin Americans can show.

BROADCASTING IN BRAZIL

In the meantime, broadcasting on a purely temporary basis has been entertaining the citizens of Argentine's neighbor to the north, Brazil. Due to strict legal prohibition of the use of radio transmitting and receiving equipment in Brazil, except for Government and licensed commercial purposes, amateur radio has not yet had a chance to develop there. However, when plans were drawn for the Brazilian Centennial Exposition, to celebrate the 100th anniversary of the country's independence, it was decided that radio broadcasting must be demonstrated, for exposition purposes at least.



One end of the transmitting antenna on top of Mount Corcovado, towering over Rio de Janeiro, Brazil

A temporary concession was awarded to the Westinghouse International Company, which agreed to establish a broadcasting station at Rio de Janeiro, where the exposition is being held. The necessary apparatus was shipped, and Mount Corcovado, a spectacular peak 2,000 feet high, situated on the harbor of Rio, was chosen as the site of the station. The mountain is climbed by a cog-wheel railway, its peak being a favorite observation point. Here two 125-foot masts were erected, and a 153-foot 6-wire aerial swung between them. Down the mountain side was run a counterpoise. The station was given the call SPC, and immediately sprang into great favor. Receiving sets were located in many parts of the Exposition, and in the various clubs and other offices in the city that are the centers of the official and semi-offical life of the Brazilian capital.

The programs that have been broadcast include speeches by prominent Brazilians, and also operas from the local opera house, from which a telephone line was run to the transmitter at the top of the mountain. The station has been reported heard at a distance of 1,000 miles north and south.

ONLY TEMPORARY

At present it seems that when the Brazilian exposition ends the broadcasting concession will terminate also, and that then the ether in Brazil once more will contain only the dots and dashes of commercial transmitters, and such radio telephone waves as may wash over into Brazil from her neighbors. Officially, the present status of broadcasting in Brazil is that of an exposition attraction.

However, the Brazilians now realize the enormous advantages presented by broadcasting, its great service in spreading news, culture and entertainment to the four winds. They are beginning to demand of their Government that the ban upon amateur radio be lifted. Those who are in close touch with the situation state that there is every hope that in the near future new regulations will be promulgated that will enable the continuous operation of broadcasting stations in Rio and other Brazilian cities, and permit the purchase and use of receivers on the part of the general public.

While all this is happening in Argentine and Brazil, the other South American countries are watching the course of events with eager eyes. Broadcasting eventually will be heard in all modern centers of South America.

Above, the Monroe Mansion and entrance to the Brazilian National Exposition. This is the broadcasting studio

The Bay of Botafogo is dominated by Corcovado. Left, Rio as seen from the spars supporting the broadcasting antenna

Radio Helps Catch Herrings

USE of the radio telephone for reporting schools of herring has been developed by Sweden, whose government radio station broadcasts daily reports to the fishing fleet. The approximate locations and direction of movement of all schools, as reported to the government and transmitted by radio enable the fleets, equipped with receivers, to waste little time in hunting for the fish that is so important an article in Swedish commerce. In addition to the herring news, the weather reports, forecasts, and storm warnings give the fishermen time to seek shelter before the gales themselves give notice of approaching danger. News bulletins also keep the fishermen advised of daily happenings of importance in Sweden and throughout the world.

Radio Telephony in France

By Milton S. Waldman

WITH no great excitement or fuss, broadcasting has slipped into its place in French life in a manner that promises its permanence. The Government assumed without question the duty of transmission, the electric shops quietly took over the sale of apparatus, and the public knew where to look for the one and the other. Probably in no other country did radiotelephony (here universally styled TSF—*téléphonie sans fil*) enter in such full maturity and with so many problems already solved at introduction.

Incidentally, before I left London there was great excitement about a radio-equipped automobile, which would now scarcely draw a handful of spectators in America, and which I am sure, would no longer attract much attention here in Paris.

I can safely say that I have never listened to or heard of finer programs than are given by the stations in and near Paris. The Eiffel Tower's schedule at five o'clock in the afternoon has music of an order that would be welcomed in a concert hall. These concerts are public, and large audiences listen to them directly while still larger audiences are hearing them via the TSF. The cooperation is obtained, not only of famous individual artists, but of managers and impresarios; hence one can hear entire bills by famous stars of the Comédie Française and the Opera Comique. Such world-renowned musicians as Victor Charpentier and Archambaud have undertaken the direction of radio concerts. There is not nearly so much broadcasting here as in America, but what there is strikes, in my opinion, a far higher average.

With the French franc worth scarcely more than one-third its par value the price of radio equipment is ridiculously low to American eyes. I have before me a set with one detector and one amplifier bulb which will receive voice and music at 400 miles and signals from all over Europe—on favorable nights even from America—a thrilling event you may be sure, which costs without tubes or batteries about $30, and $50 should be sufficient to rig up a set equivalent to anything selling in America for three times the price or more. A two-stage detector and amplifier panel is priced at about $14 complete. The catalogue before me, issued by one of the biggest shops in Paris, located on the Rue de Rivoli, offers 40-volt dry batteries at about $2.50; fifty-ampere storage batteries at $12—good for about fifty ampere hours with three lamps, is the claim—ebonite knobs at six cents, and a wonderful 4,000-ohm headpiece for about $4.50. I am basing these quotations on the present value of the franc, about 6½ cents.

French Rules for Receivers

THE French Ministry of Posts and Telegraphs, which is in control of radio transmitting and receiving in France, is developing new regulations for receiving sets, which at present bear a strong resemblance to the rules now in effect in England. The plans drawn up by Paul Laffont, Minister of Posts and Telegraphs, call for a yearly license fee of 10 francs, prohibit the use of apparatus that will interfere with others—probably prohibiting regeneration, as in England—and require that the owner must be a French citizen. The Minister also thinks it necessary to warn owners that their apparatus is liable to requisition in time of war or at any time.

European Broadcasting Schedules

Some of these transmissions are commercial or official. Wavelengths and times are liable to alteration without notice.

London B.B.C.* Station (2LO), 369 meters. Daily, 5 p.m. to 5.45 p.m., children's stories; 7 p.m. to 10.30 p.m., concert and news.

Manchester B.B.C.* Station (2ZY), 385 meters. Daily, 4.30 p.m. to 5 p.m., concert; 6 p.m. and 6.15 p.m., kiddies' corner; 6.30 p.m. to 7 p.m., reproducing-piano recital; 7 p.m., news bulletin; 8 p.m. to 9.10 p.m., concert; 9.15 p.m., second news bulletin; 9.30 p.m. to 10 p.m., miscellaneous concert.

Birmingham B.B.C.* Station (5IT), 420 meters. Weekdays: 6.30 p.m., children's stories; 7 p.m., concert; 7.30 p.m., news bulletin; 8.30 p.m. to 9 p.m., interval; 9 p.m., concert; 9.45 p.m., second news bulletin; 10 p.m., final announcements. Sundays: 8 p.m., news bulletin; 8.10 p.m. to 9.45 p.m., concert; 9.45 p.m., second news bulletin; 10 p.m., final announcements.

Newcastle B.B.C.* Station (5NO), 400 meters. Daily, usually 7 p.m. to 10 p.m.

Cardiff B.B.C.* Station (5WA), 395 meters. Daily, 5 p.m. to 5.45 p.m., children's stories; 7.30 p.m. to 10 p.m., concert and news.

Croydon (GED), 900 meters. Daily.

Writtle (2MT), 400 meters. Tuesdays, 8 p.m.

Eiffel Tower (FL), 2,600 meters. Daily, 6.20 p.m. to 7 p.m., concert, and 10.10 p.m. to 10.20 p.m., concert (weekdays only).

The Hague (PCGG), 1,085 meters. Sundays, 3 p.m. to 5 p.m.

Paris. Concerts Radiola. 1,565 meters. Daily, 5.05 p.m. to 6 p.m., concert; 8.45 p.m. to 9.55 p.m., concert; also concert from 2 p.m. to 3 p.m. on Sundays.

Rome (ICD), 3,200 meters. Daily, 10 a.m.

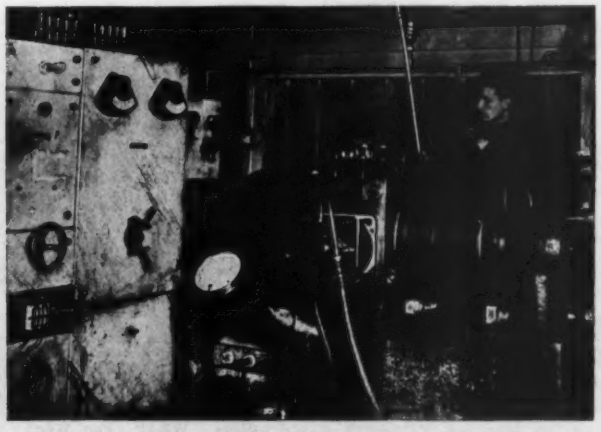
Königswusterhausen (LP), 2,800 meters. Daily, 4 p.m. to 5.30 p.m.

Amsterdam (PCA), 1,800 meters. Daily, 1.10 p.m.

Haren (OPVH), 900 meters. Daily, every hour from 11.20 a.m. to 4.20 p.m.; 12 noon and 4.50 p.m., weather reports on 1,100 meters.

* British Broadcasting Company.

"Ici poste militaire de la Tour Eiffel . . . " is heard daily in this Paris shop that sells the latest French radio receivers, seen on the tables. The eight horns high in the background are loud speakers



And this is the "post militaire" or military station of the Eiffel Tower, or a small part of it, being only the Poulsen arc transmitter. There are several other high power transmitters used

Distant Broadcasting Stations Heard

Broadcasting fans daily surprise themselves and others by reaching out across hundreds of miles by a turn of the wrist. Often the most simple bulb equipment will produce astonishing results, as reported below. What have YOU done?

WM. L. BLAKELY, Kansas City, Mo., is enjoying his one-tube receiver hearing stations on both Coasts and in Canada:

WGY	Schenectady, N. Y.	1,300 Miles
KFDB	San Francisco, Cal.	1,550 Miles
WHAZ	Troy, N. Y.	1,325 Miles
CFCA	Toronto, Canada	1,000 Miles
KZM	Oakland, Cal.	1,400 Miles
KGN	Portland, Ore.	1,775 Miles
WJZ	Newark, N. J.	1,350 Miles
WGL	Philadelphia, Pa.	1,250 Miles
CFCN	Calgary, Canada	1,300 Miles
WNAC	Boston, Mass.	1,300 Miles

EDWARD BAHR, Atlantic Highlands, N. J., has heard distant stations, using a 3-circuit regenerative set and detector:

WLAG	Minneapolis, Minn.	1,000 Miles

J. E. HILTS, Rochester, N. Y., uses a single circuit regenerative hook-up, with a WD-11 tube:

WCM	Austin, Tex.	1,500 Miles
WAAC	New Orleans, La.	1,100 Miles
WEAT	Tampa, Fla.	1,100 Miles

O. N. GAY, Mendon, Ill., has a 2-stage set, but on seeing the records for detector alone on this page, turned off his amplifier and got the following:

KHJ	Los Angeles, Cal.	1,700 Miles

JOHN LEAVITT, Hollis, L. I., N. Y., has a 75-foot antenna and hears the following stations on a loud speaker:

WGF	Des Moines, Iowa	1,100 Miles
PWX	Havana, Cuba	1,250 Miles

J. R. NEWMAN, Pittsburgh, Pa., has a single-tube circuit in the heart of the resident district of Pittsburgh, with 100-foot antenna running fairly close to a power line. Nevertheless he has been able to hear the East, South, West and Southwest.

WOAI	San Antonio, Tex.	1,300 Miles
WEAM	New Orleans, La.	1,000 Miles

W. J. FISHER, East McKeesport, Pa., has a single circuit regenerative receiver and has heard the following stations on the detector alone:

PWX	Havana, Cuba	1 150 Miles
KFI	Los Angeles, Calif.	2,200 Miles
WFAA	Dallas, Tex.	1,200 Miles
WLAG	Minneapolis, Minn.	1,000 Miles
CJCE	Vancouver, B. C.	2,450 Miles
WPAC	Okmulgee, Okla.	1,200 Miles
WGV	New Orleans, La.	1,100 Miles

O. J. NELSON, Rockford, Ill., made a one-tube set on Christmas day and since then has heard both Atlantic and Pacific Coasts, Canada to the North, and Texas to the South.

KPI	Los Angeles, Calif.	1,700 Miles
KHJ	Los Angeles, Calif.	1,700 Miles
KWH	Los Angeles, Calif.	1,700 Miles
KPO	San Francisco, Calif.	1,800 Miles

B. ADAMS, Ferndale, Cal., likes the single circuit regenerative type of hook-up, and uses that with a one-step amplifier.

		Miles
KSD	St. Louis, Mo.	1,700
WMAM	Beaumont, Tex.	1,700
WBAP	Fort Worth, Tex.	1,400
WDAF	Kansas City, Mo.	1,500
CJCG	Winnipeg, Man., Can.	1,550
CFCN	Calgary, Alta., Can.	1,100
WKY	Oklahoma City, Okla.	1,450

VERNON CHABERD, Youngstown, O., submitted a list of 35 stations heard in a single night with a regenerative set with detector tube only.

		Miles
PWX	Havana, Cuba	1,275
WAAC	New Orleans, La.	1,025
WFAA	Dallas, Tex.	1,050
WBAP	Fort Worth, Tex.	1,100

V. O. FIGGE, Ossian, Ia., reaches both east and west with ease, and hears Los Angeles regularly.

		Miles
WKAQ	San Juan, P. R.	2,300
PWX	Havana, Cuba	1,600
KHJ	Los Angeles, Cal.	1,500

J. W. BOWSER, Punxsutawney, Pa., 3AGV, likes a non-regenerative hook-up, and with the detector only hears:

		Miles
WFAA	Dallas, Tex.	1,150
WBAP	Fort Worth, Tex.	1,250
KLB	Pasadena, Cal.	2,150

ERCOLE L. CHELLI, San Rafael, Cal., only wishes the "DX period was longer, as it is surely interesting."

		Miles
WGR	Buffalo, N. Y.	2,250

MARVIN MARTENS, Charles City, Ia., has a "Charles City Special," a one-tube set so called because of its popularity among boys who build their own.

		Miles
WGY	Schenectady, N. Y.	1,100
WEAF	New York City	1,000
WJZ	Newark, N. J.	1,000

C. S. CORDON, Bridgeport, Conn., finds one step of amplification is sufficient to make nearly every distant station audible all over the room, including:

		Miles
PWX	Havana, Cuba	1,300

EUGENE SULLIVAN, Atchison, Kan., who is fifteen years old, has had a single tube set for about a month and is proud of having "caught" a number of distant stations:

		Miles
KDKA	Pittsburgh, Pa.	800
WHAS	Louisville, Ky.	500
WWJ	Detroit, Mich.	650
WLW	Cincinnati, Ohio	550
WBAP	Forth Worth, Tex.	600
WSB	Atlanta, Ga.	700

DAVID B. HEXTER, New York City, says, "How's this for a single tube regenerative set in the big city?"

		Miles
WWJ	Detroit, Mich.	500
WDAP	Chicago, Ill.	750
WDAJ	College Park, Ga.	750
WOC	Davenport, Iowa.	850

WDAP	Chicago, Ill.	850
WMAQ	Chicago, Ill.	850
WWJ	Detroit, Mich.	600
WIAO	Milwaukee, Wis.	850
WAAK	Milwaukee, Wis.	850
WHB	Kansas City, Mo.	1,250
KSD	St. Louis, Mo.	1,050
WOC	Davenport, Ia.	1,000
WHAS	Louisville, Ky.	800
WLW	Cincinnati, O.	750
WJAX	Cleveland, O.	550
WBAP	Fort Worth, Tex.	1,600
PWX	Havana, Cuba	1,450

EARL MOORE, Salina, Kansas, is much bothered by a large flour mill opposite him, which uses five powerful electric machines for bleaching flour. These operate from 7 a. m. Monday morning to 7 a. m. the following Sunday morning, and the interference from them is so great that reception of any kind is most difficult. However, with a 3-circuit regenerative tuner he has been able to hear the following:

KPO	San Francisco, Calif.	1,325 Miles
WKAH	Palm Beach, Fla.	1,315 Miles
WGY	Schenectady, N. Y.	1,265 Miles
WEAF	New York City	1,265 Miles
WJZ	Newark, N. J.	1,250 Miles
KOG	Los Angeles, Calif.	1,175 Miles
KHJ	Los Angeles, Calif.	1,175 Miles
KWH	Los Angeles, Calif.	1,175 Miles
KFI	Los Angeles, Calif.	1,175 Miles
WGAL	Lancaster, Pa.	1,140 Miles
WMAK	Lockport, N. Y.	1,030 Miles
CFCA	Toronto, Canada	1,010 Miles
WBAG	Bridgeport, Pa.	1,100 Miles

PAUL F. HAHN, Rochester, N. Y., uses a single circuit receiver with one stage of audio-frequency amplification. For an antenna he uses two sets of bed-springs.

WGM	Atlanta, Ga.	1,200 Miles
WSB	Atlanta, Ga.	1,200 Miles
WOS	Jefferson City, Mo.	1,000 Miles
WHB	Kansas City, Mo.	1,035 Miles
WDAF	Kansas City, Mo.	1,035 Miles
WBAP	Fort Worth, Tex.	1,400 Miles

DELWAY SMITH, Waco, Texas, reports the following stations as heard on a crystal set, in one evening:

WOAA	Dallas, Tex.	100 Miles
WOAI	San Antonio, Tex.	175 Miles
WAAH	St. Paul, Minn.	910 Miles
WBAP	Fort Worth, Tex.	100 Miles
KSD	St. Louis, Mo.	660 Miles
WAAP	Wichita, Kans.	415 Miles
WHB	Kansas City, Mo.	600 Miles

L. S. MCMICKIN, Needville, Texas, is another Texan who reports excellent results with a crystal detector:

KSD	St. Louis, Mo.	710 Miles
WBT	Charlotte, N. C.	925 Miles
WCK	Detroit, Mich.	1,100 Miles
WHB	Kansas City, Mo.	700 Miles
WLB	Minneapolis, Minn.	1,100 Miles
WOC	Davenport, Iowa	975 Miles
WOR	Newark, N. J.	1,500 Miles
WSB	Atlanta, Ga.	675 Miles
WAAB	New Orleans, La.	325 Miles
WAAY	Youngstown, Ohio	1,175 Miles
WDAF	Kansas City, Mo.	700 Miles
WHAA	Iowa City, Ia.	975 Miles
WHAN	Wichita, Kans.	625 Miles

EDWIN W. KINN, West Hoboken, N. J., is one of the first listeners reporting hearing California broadcasting. He has a regenerative set and found one step of audio-frequency amplification sufficient to reach the Pacific Coast:

WDAF	Kansas City, Mo.	1,100 Miles
WDAY	Fargo, N. D.	1,200 Miles
WBAP	Fort Worth, Tex.	1,400 Miles
WFAA	Dallas, Tex.	1,400 Miles
PWX	Havana, Cuba	1,400 Miles
KHJ	Los Angeles, Calif.	3,000 Miles

ROBERT GEIGER, Kalamazoo, Mich., has submitted a list of stations heard over distances of less than 1,000 miles.

FRANKLIN L. BENNETT, Stoneham, Mass., has a crystal set for which he reports the following results:

KSD	St. Louis, Mo.	1,100 Miles
KDKA	Pittsburgh, Pa.	575 Miles
NOF	Washington, D. C.	500 Miles
WOO	Philadelphia, Pa.	300 Miles
WIZ	Philadelphia, Pa.	300 Miles
WJZ	Newark, N. J.	250 Miles
WAAM	Newark, N. J.	250 Miles
WEAF	New York, N. Y.	200 Miles
WBAY	New York, N. Y.	200 Miles
WHAZ	Troy, N. Y.	180 Miles
WGY	Schenectady, N. Y.	170 Miles

CHARLES A. HALL, Providence, R. I., has heard the following stations on a single WD-11 tube:

WHY	Kansas City, Mo.	1,200 Miles
WOC	Davenport, Iowa	1,000 Miles
PWX	Havana, Cuba	1,975 Miles
KSD	St. Louis, Mo.	1,050 Miles

HAROLD PIKE, Fair Grove, Mich., joins the ranks of those who heard both Coasts, Canada and Cuba:

KHJ	Los Angeles, Calif.	2,000 Miles
KFI	Los Angeles, Calif.	2,000 Miles
KWH	Los Angeles, Calif.	2,000 Miles
PWX	Havana, Cuba	1,400 Miles
WHAB	Galveston, Tex.	1,200 Miles
WOAI	San Antonio, Tex.	1,280 Miles
KLZ	Denver, Colo.	1,175 Miles
KFAF	Denver, Colo.	1,175 Miles
DN4	Denver, Colo.	1,175 Miles
WPA	Fort Worth, Tex.	1,050 Miles
WBAP	Fort Worth, Tex.	1,050 Miles
WFAA	Dallas, Tex.	1,040 Miles
WAAC	New Orleans, La.	1,000 Miles
WGV	New Orleans, La.	1,000 Miles

BERNARD SEURYNCK, Detroit, Mich., has a single circuit tuner and detector alone:

PWX	Havana, Cuba	1,300 Miles
WBAP	Fort Worth, Tex.	1,050 Miles

CLARENCE F. KRAMER, Lebanon, Ind., operator of station 9AOB, sends the following list of stations heard on a crystal set:

KDKA	Pittsburgh, Pa.	350 Miles
WWJ	Detroit, Mich.	225 Miles
WCX	Detroit, Mich.	225 Miles
WHA	Madison, Wisc.	250 Miles
WDAF	Kansas City, Mo.	450 Miles
WHB	Kansas City, Mo.	450 Miles
WSB	Atlanta, Ga.	450 Miles
WGM	Atlanta, Ga.	450 Miles
WGY	Schenectady, N. Y.	675 Miles
WHAZ	Troy, N. Y.	700 Miles
KYW	Chicago, Ill.	150 Miles
WMAQ	Chicago, Ill.	150 Miles
WHAS	Louisville, Ky.	150 Miles
WOC	Davenport, Iowa	250 Miles
WKN	Memphis, Tenn.	400 Miles
WAAP	Wichita, Kans.	625 Miles
WFAA	Dallas, Tex.	775 Miles
KSD	St. Louis, Mo.	225 Miles
WJZ	Newark, N. J.	625 Miles
WDAJ	College Park, Ga.	500 Miles
WLAG	Minneapolis, Minn.	500 Miles
WKY	Oklahoma City, Okla.	700 Miles
WBAP	Ft. Worth, Tex.	825 Miles
WMGE	Duluth, Minn.	550 Miles
WOI	Ames, Iowa	400 Miles
WSY	Birmingham, Ala.	450 Miles
WEAO	Columbus, Ohio	175 Miles

Listening In Here and There

"SERVICE with a Smile"—that's the motto of Silvy's Place in Colorado Springs, Col. "Silvy" is Harold M. Silverstein, and his place is a cigar shop and newsstand, and a popular one too, now that radio concerts fill the air to blend with the aroma of tobacco and vie with the magazines for the interested attention of passers-by. "I get all concerts everywhere in the United States as clear as a bell," writes Silvy, and he is happy about it, not only because he enjoys what he hears, but also because his friends and customers enjoy it too. This means better business for his shop, and also gives his friends more reason than ever for their friendship. He who has a radio set—is he not worthy of cultivation? asks everybody, and Silvy thinks he is not only worthy of it, but gets it in two ways; his friends are more than ever attentive, and the broadcast concerts and lectures add to the cultivation of the listener. "Service with a Smile" is Silvy's motto, and radio helps him give it. It is seldom that one can combine business and pleasure as he does now, by radio. It's not a one-sided affair at all. It's fun for Silvy and for his customers, and good business for him too. And maybe some of his smoking friends get profit from it also.

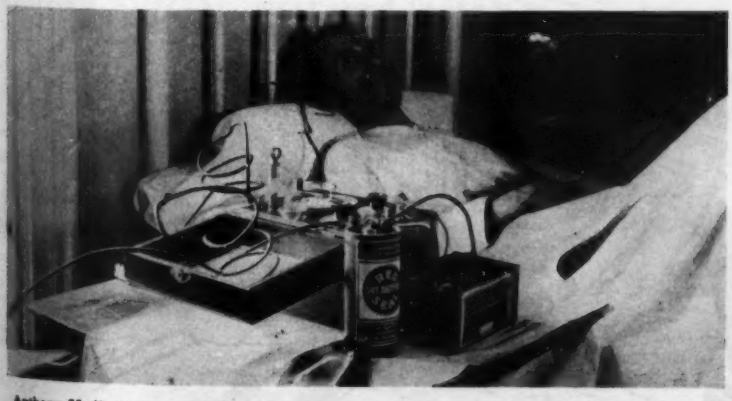
Silvy, his service and his smile, as seen by visitors to Colorado Springs, Col., when they drop in to buy their smokes

How Radio Comes to One Hospital Bed

ANTHONY MODJESKI has spent the last ten years in a hospital in Grand Rapids, Mich. A mysterious disease during that time has been gradually ossifying every joint in his body, so that today many of them seem to be solid bone. He can move only slightly.

In spite of this great and sometimes painful affliction, Anthony has been cheerful, and by his patience and uncomplaining attitude has endeared himself to the nurses, the doctors, and all who have visited him. So it was not strange that when radio broadcasting arrived somebody gave him a receiving set, of the vacuum tube type. Thereby is Anthony's life given new interest, and a joy he had not known for years.

He used to be active. He liked people, liked to be with them, to participate in the affairs of the city, to keep his finger on the pulse of things, so to speak. If anything happened around Grand Rapids, Anthony knew about it before the papers did, usually, and it was a great hardship to him to have to give up all this activity for a life of rigid inaction in a hospital bed. Now by radio he hears the city, and more, the Middle West. It has brought back to him everything he used to enjoy, and many things that he never enjoyed before. "Thank God for raido," says Anthony Modjeski. "It's a gift right from Him."



Anthony Modjeski lies in his hospital bed in Grand Rapids and listens by radio to the world in which he used to take such an active part

Put "Taximeter" on Radio Receiver

THE first report from any source that taximeters were used to measure the amount of entertainment received from a radiophone comes from Buenos Aires, Argentina. During a school festival in that city recently, the radio fans of a college in Belgrano, a suburb of the Argentine capital, constructed a radio receiving set with a number of headphones attached to the output of the set. Each pair of phones hung over a comfortable chair, and on the wall behind the chair, was a specially constructed "taximeter," run by clockwork. In this way the listening-in time is metered.

This novel arrangement paid for itself in a single day of operation. The minimum charge for "listening-in" was twenty centavos, which gave the listener three minutes of radiophone music. For every minute after the initial period, the taximeter registered ten centavos, so that five minutes of the sport would cost fifty centavos in Argentine money, or about twenty cents American silver.

Some persons, states the "Revista Telegrafica," in which the "stunt" was reported, listened to the music and forgot entirely that there was such a thing as time, with the result that when they laid down the headphones, they could scarcely believe the reading of the meter, the charge was so great. It might be well for the listeners in America to appreciate the radio broadcasting station at home, where conditions are such that anyone can put together a receiving set and listen in for hours free of charge.

Cartoonists' Pens Are Busy with Wireless Witticisms for All

SIMEON BATTS

By HAENIGSEN

MERCY! YOU'RE HOME EARLY!
YOU SAID IT OL' GIRL! I'M GOING TO HEAR THE WORLD SERIES ON MY RADIO THIS AFTERNOON!
I COULDN'T GET A TICKET TO THE GAME - BUT I'D LIKE TO SEE ANYONE DEPRIVE ME OF THE THRILL OF RECEIVING IT ON MY OWN LITTLE SET.
THE WAY SHE'S WORKING TODAY I'LL BE ABLE TO HEAR THE SODA POP SIZZING! ITS ALMOST TIME - THEY START AT 2 o'clock.
BUT SIMEON - THE PAPER SAYS THAT J.A.Z. IS GOING TO BROADCAST A TALK BY MME. LA PIPP ON FALL FASHIONS AT 2 o'clock.
SIMEON - JUST E-E-MAGINE!!! A FROCK OF RED KASHA SERGE EMBROIDERED IN SILVER SOUTACHE BRAID ISNT THAT A DREAM!
AT ABOUT THE FIFTH INNING
RATS!

—N. Y. Mail

NEIGHBORHOOD NEWS

By FONTAINE FOX

WHILE MR. WIGGINS WAS LISTENING TO A JAZZ ORCHESTRA VIA RADIO, BURGLARS ENTERED AND MADE A CLEAN-UP OF ALMOST EVERYTHING OF VALUE ON THE FIRST FLOOR.

—N. Y. Globe

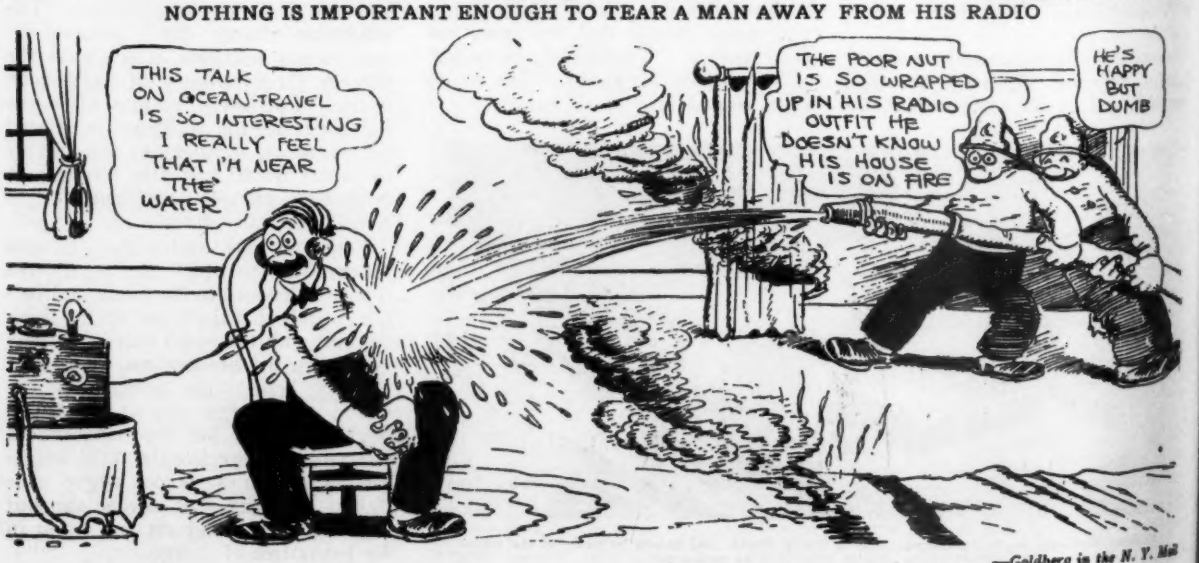
SCHOOL DAYS

By DWIG

I GOT DANDRUFF, MOMMA LAST NIGHT —
A- COURSE YOU COULDN'T GIT 'ER ON THIS LITTLE OLE HOMEMADE PIECE O' JUNK
THESE IS THE HAPPY DAYS

—Philadelphia Public Ledger

NOTHING IS IMPORTANT ENOUGH TO TEAR A MAN AWAY FROM HIS RADIO


THIS TALK ON OCEAN-TRAVEL IS SO INSTERESTING I REALLY FEEL THAT I'M NEAR THE WATER
THE POOR NUT IS SO WRAPPED UP IN HIS RADIO OUTFIT HE DOESN'T KNOW HIS HOUSE IS ON FIRE
HE'S HAPPY BUT DUMB

—Goldberg in the N. Y. Mail

Laughter on the Radio Wave

Rah! Rah!! Rah!!!

It is proposed to conduct college courses by radio. That's fine. Only we see difficulties on graduation day. John Brown, frinstance, tunes in for his B.A. degree, and instead finds himself decorated with a First Class Hand Holder's certificate by the Mary & Jane Manicure School. And Clara Homebody, domestic scientist who has learned all about making pies and beds and things at home, refuses to wear an apron any more because she is—take it from the radio—Ph.D., LL.D. and D.C.L. While Hiram Snaffle, who knows all about stock raising and horse breeding, including its attendant assortment of cuss words, gets a D.D., and everything that goes with it except the pulpit.

However, probably we shouldn't complain until they try to play baseball by radio. A home run, for instance—into whose home? "Not in mine," would be the universal chorus, and the poor batter would be left hanging up in the air with no place to go.

And what would the radio rah-rah-boys do, poor things—hang their frat pins on their antennas? Would they be required to install transmitters in order to give the class yell?

The only alleviating aspect is that the radio college could only claim tuition fees by radio, and of course if it didn't get them, that would be the fault of its receiver, not of its students, oh no, no, *nonono!*

"HARK FROM THE TOMB"

philadelphia egypt february twenty seven 5223 a t after refusing for over thirty three hundred years to speak over the radiophone king tutankhamen at last consented to broadcast a few words today said he this is station t u t kings valley interment association members of the radio audience i wish to correct the many mispronunciations of my name that i hear daily pronounce t as in tutt a as in ank and hayman like an englishman except the accent is on the first syllable some people call me two tanker men but that sounds two much like two gun smith and besides why remind us of the wonderful light wines and beer we had in the days when gold was cheap enough to use for bedclothes i send special greetings to the city in the far west that is named after ours and i often think that perhaps there too some one will actually wake up in thirty three hundred years this is station t u t signing off until 8523 a t good afternoon jorje clairek.—N. Y. *World.*

Do You?

"Radio" is a terrible creed—
I like it.
It satisfies no normal need—
I like it.
It makes you thin, it makes you lean,
It takes your hair right off'n your bean,
It's the worst darn stuff I've ever seen,
BUT—I like it!
—N. Y. *Evening Mail.*

Bedtime Story

Once upon a time, my dears, there was a father who had twin sons who were so much alike that he couldn't tell them apart. So he sent one to Yale and the other to Harvard, but after they had graduated he still couldn't tell which was which. Then he made one spend a year in Germany and the other a year in France, but still he couldn't tell them apart. So he made one a radio amateur, and the other a broadcast listener, and after that he couldn't tell either of them anything.—G. W. Z.

A STRAIN ON THE FAMILY TREE

I CAN'T SEE FOR THE LIFE OF ME WHY YOU SPEND ALL EVENING FOOLIN' 'ROUND FOR FT. WORTH OR ATLANTA, WHEN THERE'S FOLKS SINGIN' AN' PLAYIN' AN' ANNOUNCIN' RIGHT HERE NEARER HOME! AND A LOT LOUDER!

—N. Y. *News*

Wise Crack-les

HAM: "What's the best circuit?"
BAM: "Horse racing, vaudeville, or radio?"

F. X. McC. says the way the announcers rip out their call letters nowadays reminds him of his Ford, which rattled off its license plates the other day. And they're not the only things a Ford will rattle off, if his is anything like ours.

OH, RATS!

J. H. T., who rolled his own in his father's barn, wants to know what's been nibbling at the spaghetti.

Radio bugs, of course.

WINDY CITY STUFF

G. W. G. wants to know if it is necessary to move to Chicago in order to use the Loop.

O. M., a movie operator in Hollywood, says the revenooers overlooked the condenser part of his home brewery, and can he use it in a radio set? No, that's for taking still pictures with.

Cowboy Song, New Style

Whiles I was a-ridin' to San Antone
(*Roll along, Lizzie, roll along*)
Thar went my gas tank drier 'n a bone
(*An' I ain't in a hurry nohow*).

Nothin' but cactus, nothin' but dirt,
And you cain't start a Ford with spur ner quirt.

Plumb out o' gas, I'd been thar yet,
Ef I hadn't brought along my radio set.

Listen, you cowboys, listen to my song—
Allus take your radio set along.

Told my troubles to the desert air,
And along come a waddy that had gas to spare.

He on his pinto Liz, me on my roan
(*Roll along, Lizzie, roll along*)
Went down lopin' into San Antone
(*An' I ain't in a hurry nohow*).

S. K., in *Life.*

BROADCASTING STATION DIRECTORY

(Revised to March 20th, 1923)

Class B stations, broadcasting on 400 meters, are designated by ★

KAO	Young Mens' Christian Association	Denver, Colo.
KDN	Lee U. Meyerberg Co.	San Francisco, Calif.
★KFI	E. C. Anthony	Los Angeles, Calif.
KFV	Foster Bradbury Radio Store	Yakima, Wash.
KFZ	Doerr Mitchell Elec. Co.	Spokane, Wash.
KGB	Wm. A. Mullins Electric Co.	Tacoma, Wash.
KGG	Hallock & Watson Radio Service	Portland, Ore.
KGN	Northwestern Radio Mfg. Co.	Portland, Ore.
KGO	Altadena Radio Laboratory	Altadena, Calif.
KGU	M. A. Muirony	Honolulu, Hawaii.
★KGW	Oregonian Publishing Co.,	Portland, Ore.
KGY	St. Martin's College	Lacey, Wash.
KHD	Aldrich Marble & Granite Co.,	Colorado Springs, Colo.
★KHJ	Times Mirror Co.	Los Angeles, Calif.
KHQ	Louis Wasmer	Seattle, Wash.
KJJ	The Radio Shop	Sunnyvale, Calif.
KJQ	C. O. Gould	Stockton, Calif.
KJR	Vincent I. Kraft	Seattle, Wash.
KJS	Bible Institute of Los Angeles, Inc.,	Los Angeles, Calif.
KLB	J. J. Dunn & Co.	Pasadena, Calif.
KLN	Noggle Electric Works	Monterey, Calif.
KLP	Colin B. Kennedy Co.	Los Altos, Calif.
KLS	Warner Brothers	Oakland, Calif.
KLZ	Tribune Publishing Co.	Oakland, Calif.
KLZ	Reynolds Radio Co.	Denver, Colo.
KMC	Lindsay-Weatherill & Co.	Readley, Calif.
KMJ	San Joaquin Light & Power Co.	Fresno, Calif.
KMO	Love Electric Co.	Tacoma, Wash.
KNI	T. W. Smith	Eureka, Calif.
KNJ	Roswell Public Service Co.	Roswell, N. M.
KNN	Bullock's	Los Angeles, Calif.
KNT	North Coast Products Co.	Aberdeen, Wash.
KNV	Radio Supply Co.	Los Angeles, Calif.
KOA	Y. M. C. A.	Denver, Colo.
KOB	New Mexico College of Agriculture and Mechanical Arts,	State College, N. Mex.
KOG	Western Radio Electric Co.	Los Angeles, Calif.
KON	Holzwasser, Inc.	San Diego, Calif.
KOP	Detroit Police Dept.	Detroit, Mich.
KOQ	Modesto Evening News	Modesto, Calif.
★KPO	Hale Brothers	San Francisco, Calif.
KQI	University of California	Berkeley, Calif.
KQP	Blue Diamond Electric Co.	Hood River, Ore.
KQV	Doubleday-Hill Electric Co.	Pittsburgh, Pa.
KQW	Charles D. Herrold	San Jose, Calif.
KQY	Stubbs Electric Co.	Portland, Ore.
KRE	Maxwell Electric Co.	Berkeley, Calif.
★KSD	Post Dispatch	St. Louis, Mo.
KSL	The Emporium	San Francisco, Calif.
KSS	Prest & Dean Radio Rsch. Lab.	Long Beach, Cal.
KTW	First Presbyterian Church	Seattle, Wash.
KUO	The Examiner Printing Co.	San Francisco, Cal.
KUS	City Dye Works & Laundry Co.	Los Angeles, Cal.
KUY	Coast Radio Co.	Del Monte, Calif.
KWG	Portable Wireless Telephone Co.	Stockton, Calif.
KWH	Los Angeles Examiner	Los Angeles, Calif.
KXD	Herald Publishing Co.	Modesto, Calif.
KXB	Braun Corporation	Los Angeles, Calif.
KYI	Alfred Harrell	Bakersfield, Calif.
KYJ	Leo J. Meyberg Co.	Los Angeles, Calif.
KYQ	Electric Shop	Honolulu, T. H.
★KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.
KZM	Preston, D. Allen	Oakland, Calif.
KZN	The Desert News	Salt Lake City, Utah
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.
★KDKA	Westinghouse Electric & Mfg. Co.,	Pittsburgh, Pa.
KDPT	Southern Electric Co.	San Diego, Calif.
KDYL	Telegram Publishing Co.	Salt Lake City, Utah
KDYM	Savoy Theatre	San Diego, Calif.
KDYQ	Oregon Institute of Technology	Portland, Ore.
KDYS	The Tribune, Inc.	Great Falls, Mont.
KDYV	Cope & Cornwell Co.	Salt Lake City, Utah
KDYW	Smith, Hughes & Co.	Phoenix, Ariz.
KDYX	Star Bulletin Publishing Co.	Honolulu, T. H.
KDZA	Arizona Daily Star	Tucson, Ariz.
KDZB	Frank E. Siefert	Bakersfield, Calif.
KDZE	The Rhodes Co.	Seattle, Wash.
KDZF	Automobile Club of So. Calif.	Los Angeles, Calif.
KDZG	Cyrus Peirce & Co.	San Francisco, Calif.
KDZH	Fresno Evening Herald	Fresno, Calif.
KDZI	Electric Supply Co.	Wenatchee, Wash.
KDZK	Nevada Machinery & Electric Co.	Reno. Nev.
KDZL	Rocky Mountain Radio Corp.	Ogden, Utah
KDZM	E. A. Hollingsworth	Centralia, Wash.
KDZQ	William D. Pyle	Denver, Colo.
KDZR	Bellingham Publishing Co.	Bellingham, Wash.
KDZT	Seattle Radio Association	Seattle, Wash.
KDZU	Western Radio Corporation	Denver, Colo.
KDZV	Cope & Cornwell Co.	Salt Lake City, Utah
KDZX	Glad Tidings Tabernacle	San Francisco, Calif.
KDZZ	Kinney Brothers & Skipprell	Everett, Wash.
KFAD	McArthur Brothers Mercantile Co.,	Phoenix, Ariz.
KFAE	State College of Washington	Pullman, Wash.
KFAF	Western Radio Corporation	Denver, Colo.
KFAJ	University of Colorado	Boulder, Colo.
KFAN	Electric Shop	Moscow, Idaho
KFAP	Standard Publishing Co.	Butte, Mont.
KFAQ	City of San Jose	San Jose, Calif.
KFAR	O. K. Olsen	Hollywood, Calif.
KFAS	Reno Motor Supply Co.	Reno, Nev.
KFAT	Dr. S. T. Donohue	Eugene, Ore.
KFAU	Independent School District	Boise City, Idaho
KFAV	Abbott-Kinney Co.	Venice, Calif.
KFAW	The Radio Den, Ashford & White,	Santa Anna, Cal.
KFAY	W. J. Virgin Milling Co.	Central Point, Ore.
KFAZ	C. H. Weatherall	Reddley, Calif.
KFBB	F. A. Buttrey & Co.	Havre, Mont.
KFBC	W. K. Azbill	San Diego, Calif.
KFBD	Clarence V. Welch	Hanford, Calif.
KFBE	Reuben H. Horn	San Luis Obispo, Calif.
KFBK	Kimball-Upson Co.	Sacramento, Calif.
KFBL	Loose Brothers	Everett, Wash.
KFBB	Chronicle News and Gas & Elec. Supply Co.,	Trinidad, Colo.
KFBU	Bishop N. S. Thomas	Laramie, Wyo.
KFCB	Nielsen Radio Supply Co.	Phoenix, Ariz.
KFCC	Auto Supply Co.	Wallace, Idaho
KFCD	Salem Elec. Co.	Salem, Ore.
KFCF	Frank A. Moore	Walla, Walla, Wash.
KFCH	Electric Service Station	Billings, Mont.
KFCK	Colorado Springs Radio Co.,	Colorado Springs, Colo.
KFCL	Los Angeles Union Stock Yds.,	Los Angeles, Calif.
KFCM	Richmond Radio Shop	Richmond, Calif.
KFCP	Ralph W. Fizgare	Ogden, Utah
KFCQ	Motor Service Station	Casper, Wyo.
KFCV	Fred Mahaffey, Jr.	Houston, Tex.
KFCY	Western Union College	Le Mars, Iowa
KFCZ	Omaha Central High School	Omaha, Nebr.
KFDA	Adler's Music Store	Baker, Ore.
★KFDB	Mercantile Trust Co.	San Francisco, Calif.
KFDC	Radio Supply Co.	Spokane, Wash.
KFDD	St. Michaels Cathedral	Boise, Idaho
KFDF	Wyoming Radio Corp.	Casper, Wyo.
KFDH	University of Arizona	Tucson, Ariz.
KFDJ	Oregon Agri. College	Corvallis, Ore.
KFDL	Knight-Campbell Music Co.	Denver, Colo.
KFDO	H. Everett Cutting	Bozeman, Mont.
KFDP	Hawkeye Radio & Supply Co.	Des Moines, Iowa
KFDR	Bullock's Hardware & Sporting Goods,	York, Neb.
KFDU	Nebraska Radio Elec. Co.	Lincoln, Nebr.
KFDV	Gilbrech & Stinson	Fayetteville, Ark.
KFDX	First Baptist Church	Shreveport, La.
KFEB	The City of Taft	Taft, Calif.
KFEC	Meier & Frank Co.	Portland, Ore.
KFEJ	Guy Greason	Tacoma, Wash.
KFEL	Winner Radio Corporation	Denver, Colo.
KFEP	Radio Equipment Co.	Denver, Colo.
KFEQ	J. L. Scroggin	Oak, Nebr.
KFER	Auto Electric Service Co., Inc.,	Ft. Dodge, Iowa
KFEV	Radio Electric Shop	Douglas, Wyo.
KFFA	Dr. R. C. Shelton	San Diego, Calif.
KFFE	Eastern Oregon Radio Co.	Pendleton, Ore.
KFFJ	Jenkins Furniture Co.	Boise, Idaho
KFFO	Dr. E. H. Smith	Hillsboro, Ore.
KFFQ	Markshoffel Motor Co.	Colorado Springs, Colo.
KFGB	Loewenthal Brothers	Pueblo, Colo.
KFGF	Buchanan Stevens & Co.	Mt. Vernon, Wash.
KFGG	Astoria Budget	Astoria, Oregon
KFGH	Leland Stanford, Jr., Univ.	Stanford Univ., Calif.
KFHA	Colorado State Normal School	Gunnison, Colo.
KFHJ	Fallon Co.	Santa Barbara, Calif.
WAH	Midland Refining Co.	El Dorado, Kans.
WBL	T. & H. Radio Co.	Quincy, Kans.
WBS	D. W. May, Inc.	Newark, N. J.
WBT	Southern Radio Corporation	Charlotte, N. C.
WBU	City of Chicago	Chicago, Ill.
WBZ	Westinghouse Elec. & Mfg. Co.,	Springfield, Mass.
WCE	Findley Electric Co.	Minneapolis, Minn.
WCK	Stix-Baer-Fuller	St. Louis, Mo.
WCM	University of Texas	Austin, Tex.
WCN	Clark University	Worcester, Mass.
★WCX	Detroit Free Press	Detroit, Mich.
WDM	Church of the Covenant	Washington, D. C.
WDT	Ship Owners Radio Service	New York, N. Y.
WDZ	James L. Bush	Tuscola, Ill.
WEB	Benwood Co.	St. Louis, Mo.
WEH	Midland Redining Co.	Tulsa, Okla.
WEV	Hurlburt-Still Electrical Co.	Houston, Tex.
WEW	St. Louis University	St. Louis, Mo.
★WFI	Strawbridge & Clothier	Philadelphia, Pa.
WFY	Cosradio Co.	Wichita, Kans.
WGF	The Register & Tribune	Des Moines, Iowa
WGI	American Radio and Research Corporation,	Medford Hillside, Mass.
WGL	Thomas F. J. Howlett	Philadelphia, Pa.
★WGM	Atlanta Constitution	Atlanta, Ga.
WGR	Federal Tel. & Tel. Co.	Buffalo, N. Y.
WGV	Interstate Electric Co.	New Orleans, La.
★WGY	General Electric Co.	Schenectady, N. Y.
WHA	University of Wisconsin	Madison, Wisc.
★WHB	Sweeney School Co.	Kansas City, Mo.
WHD	West Virginia University	Morgantown, W. Va.
WHK	The Radiovox Company	Cleveland, Ohio
WHN	Ridgewood Times Printing & Pub. Co.,	Ridgewood, N. Y.
WHX	Iowa Radio Corporation	Des Moines, Iowa
WIK	K. & L. Electric Co.	McKeesport, Pa.
WIL	Continental Electric Supply Co.,	Washington, D. C.
★WIP	Gimbel Brothers	Philadelphia, Pa.
WIZ	Cino Radio Mfg. Co.	Cincinnati, Ohio
WJD	Richard H. Howe	Granville, Ohio
WJH	White & Boyer	Washington, D. C.
WJK	Service Radio Equipment Co.	Toledo, Ohio
WJX	DeForest Radio Tel. & Tel. Co.	New York, N. Y.
WJZ	Radio Corporation of America—Westinghouse Elec. & Mfg. Co.,	Newark, N. J.
WKA	Landaus Music & Jewelry Co.	Wilkes-Barre, Pa.
WKC	Joseph M. Zamoiski Co.	Baltimore, Md.
WKN	Riechman-Crosby Co.	Memphis, Tenn.
WKY	Oklahoma Radio Shop	Oklahoma City, Okla.
WLB	University of Minnesota	Minneapolis, Minn.
WLK	Hamilton Mfg. Co.	Indianapolis, Ind.
WLW	Crosley Mfg. Co.	Cincinnati, Ohio
WMA	Arrow Radio Laboratories	Anderson, Ind.
WMB	Auburn Electrical Co.	Auburn, Me.
WMH	Precision Equipment Co.	Cincinnati, Ohio
WMU	Doubleday-Hill Electrical Co.	Pittsburgh, Pa.
WNJ	Shotton Radio Mfg. Co.	Albany, N. Y.
WNO	Wireless Telephone Co. of Hudson County, N. J.,	Jersey City, N. J.
★WOC	Palmer School of Chiropractic	Davenport, Iowa
WOI	Iowa State College	Ames, Iowa
WOK	Arkansas Light & Power Co.	Pine Bluff, Iowa
★WOO	John Wanamaker	Philadelphia, Pa.
WOQ	Western Radio Co.	Kansas City, Mo.
★WOR	L. Bamberger Co.	Newark, N. J.
WOS	Missouri State Mktg. Bureau,	Jefferson City, Mo.
WOU	Metropolitan Utilities District	Omaha, Nebr.
WOZ	Palladium Printing Co.	Richmond, Ind.
WPA	Fort Worth Record	Fort Worth, Tex.
WPG	Nushawg Poultry Farm	New Lebanon, Ohio
WPI	Electric Supply Co.	Clearfield, Pa.
WPM	Thomas J. Williams	Washington, D. C.
WPO	United Equipment Co.	Memphis, Tenn.
WQX	Walter A. Kushl	Chicago, Ill.
WRK	Doron Brothers Electric Co.	Hamilton, Ohio
WRL	Union College	Schenectady, N. Y.
WRM	University of Illinois	Urbana, Ill.
WRP	Federal Institute of Radio Telegraphy,	Camden, N. J.
WRR	City of Dallas (Police and Fire Signal Department),	Dallas, Tex.
WRW	Tarrytown Radio Research Laboratory,	Tarrytown, N. Y.
★WSB	Atlanta Journal	Atlanta, Ga.
WSL	J. & M. Electric Co.	Utica, N. Y.
WSY	Alabama Power Co.	Birmingham, Ala.
WSZ	Marshall-Gerken Co.	Toledo, Ohio
WTG	Kansas State Agr. College	Manhattan, Kans.
WTP	George M. McBride	Bay City, Mich.
WWB	Daily News Printing Co.	Canton, Ohio
WWI	Ford Motor Co.	Dearborn, Mich.
★WWJ	The Detroit News	Detroit, Mich.
WWL	Loyola University	New Orleans, La.
WWZ	John Wanamaker	New York, N. Y.
WAAB	Valdmar Jensen	New Orleans, La.
WAAC	Tulane University	New Orleans, La.
WAAD	Ohio Mechanics Institute	Cincinnati, Ohio
WAAF	Chicago Daily Drovers' Journal	Chicago, Ill.
WAAH	Commonwealth Electric Co.	St. Paul, Minn.
WAAJ	Eastern Radio Institute	Boston, Mass.
WAAK	Gimbel Brothers	Milwaukee, Wisc.
WAAL	Beamish Electric Co.	Minneapolis, Minn.
WAAM	L. E. Nelson Co.	Newark, N. J.
WAAN	University of Missouri	Columbia, Mo.
WAAP	Otto W. Taylor	Wichita, Kans.
WAAQ	New England Motor Sales Co.,	Greenwich, Conn.
WAAS	Georgia Radio Co.	Decatur, Ga.
WAAW	Omaha Grain Exchange	Omaha, Nebr.
WAAY	Yahrling-Raynor Piano Co.	Youngstown, Ohio
WAAZ	Hollister-Miller Motor Co.	Emporia, Kans.
WAJV	Indian Pipe Line Corp.	Princeton, Ind.
WBAA	Purdue University	West Lafayette, Ind.
WBAB	Andrew J. Potter	Syracuse, N. Y.
WBAD	Sterling Electric Co. and Journal Printing Co.,	Minneapolis, Minn.
WBAH	The Dayton Co.	Minneapolis, Minn.
WBAN	Wireless Phone Corp.	Paterson, N. J.
WBAO	James Millikin University	Decatur, Ill.
★WBAP	The Star Telegram	Fort Worth, Tex.
WBAU	Republican Publishing Co.	Hamilton, Ohio
WBAV	Erner & Hopkins Co.	Columbus, Ohio
WBAW	Marietta College	Marietta, Ohio
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.
★WBAY	American Tel. & Tel. Co.	New York, N. Y.
WCAB	Newburgh News Printing & Publishing Co.,	Newburgh, N. Y.
WCAD	St. Lawrence University	Canton, N. Y.
★WCAE	Kaufman & Baer Co.	Pittsburgh, Pa.
WCAF	Michigan Limestone & Chemical Co.,	Rodgers, Mich.
WCAG	Daily States Publishing Co.	New Orleans, La.
WCAH	Entrekin Electric Co.	Columbus, Ohio
WCAJ	Nebraska Wesleyan University,	University Pl., Neb.
WCAK	Alfred P. Daniel	Houston, Tex.
WCAL	St. Olaf College	Northfield, Minn.
WCAM	Villanova College	Villanova, Pa.
WCAO	Sanders & Stayman Co.	Baltimore, Md.
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.
WCAS	William Hood Dunwoody Industrial Institute,	Minneapolis, Minn.
WCAT	South Dakota State School of Mines,	Rapid City, S. Dak.
WCAU	Philadelphia Radiophone Co.	Philadelphia, Pa.
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.
WCAX	University of Vermont	Burlington, Vt.
WCAY	Kesselmen O'Drescoll Co.	Milwaukee, Wisc.
WDAC	Illinois Watch Co.	Springfield, Ill.
WDAD	Central Kansas Radio Supply	Lindsborg, Kans.
WDAE	Tampa Daily Times	Tampa, Fla.
★WDAF	Kansas City Star	Kansas City, Mo.
WDAH	Mine & Smelter Supply Co.	El Paso, Tex.
WDAI	Hughes Electrical Corp.	Syracuse, N. Y.
WDAJ	Atlanta & West Point R. R. Co.,	College Park, Ga.
WDAK	The Courant	Hartford, Conn.
WDAL	Florida Times Union	Jacksonville, Fla.
WDAM	Weston Electric Co.	New York, N. Y.
WDAO	Automotive Electric Co.	Dallas, Tex.
WDAP	Midwest Radio Central, Inc.	Chicago, Ill.
WDAS	Samuel W. Waite	Worcester, Mass.
WDAU	Slocum & Kilburn	New Bedford, Mass.
WDAX	First National Bank	Centerville, Iowa
WDAY	Kenneth M. Hance	Fargo, N. D.
WEAA	Fallain & Lathrop	Flint, Mich.
WEAB	Standard Radio Equipment Co.	Fort Dodge, Ia.
WEAC	Baines Electric Service Co.	Terre Haute, Ind.
WEAD	Northwest Kansas Radio Sup. Co.	Atwood, Kans.
WEAE	Virginia Polytechnic Institute	Blacksburg, Va.
★WEAF	Western Electric Co.	New York, N. Y.
WEAG	Nichols-Hinaline-Bassett	Edgewood, R. I.
WEAH	Wichita Board of Trade & Landers Radio Co.	Wichita, Kans.
WEAI	Cornell University	Ithaca, N. Y.
WEAJ	University of South Dakota	Vermillion, S. D.
WEAK	Julius B. Abercrombie	St. Joseph, Mo.
WEAM	Borough of North Plainfield,	North Plainfield, N. J.
WEAN	Shepard Company	Providence, R. I.
WEAO	Ohio State University	Columbus, Ohio
WEAP	Mobile Radio Co., Inc.	Mobile, Ala.
WEAR	Baltimore Am. & News Pub. Co.	Baltimore, Md.
WEAS	Hecht Company	Washington, D. C.
WEAT	John J. Fogarty	Tampa, Fla.
WEAU	Davidson Brothers Co.	Sioux City, Iowa
WEAV	Sheridan Electric Service Co.	Rushville, Ind.
WEAX	T. J. M. Daly	Little Rock, Ark.
WEAY	Will Horwits, Jr.	Houston, Tex.
WEAZ	Donald Redmond	Waterloo, Iowa
★WFAA	A. H. Belo & Co.	Dallas, Tex.
WFAB	Carl F. Woese	Syracuse, N. Y.
WFAC	Superior Radio Co.	Superior, Wisc.
WFAD	Watson, Weldon Motor Supply Co.,	Selma, Kans.
WFAF	Henry C. Spratley	Peachkeepsie, N. Y.
WFAG	Radio Engineering Laboratory,	Waterford, N. Y.
WFAH	Electrical Supply Co.	Port Arthur, Tex.
WFAJ	Hi-Grade Wireless Instrument Co.,	Asheville, N. C.

WFAM Times Publishing Co. .....St. Cloud, Minn.
WFAN Hutchinson Elec. Service Co...Hutchinson, Minn.
WFAQ Missouri Wesleyan College & Cameron Radio Co., Cameron, Mo.
WFAT Daily Argus Leader .....Sioux Falls, S. D.
WFAU Edwin C. Lewis, Inc. .....Boston, Mass.
WFAV University of Nebraska .....Lincoln, Nebr.
WFAW Miami Daily Metropolis .....Miami, Fla.
WFAY Daniels Radio Supply Co.....Independence, Kans.
WFAZ South Carolina Radio Shop.....Charleston, S. C.
WGAB QRV Radio Co. .....Houston, Tex.
WGAC Orpheum Radio Stores Co. .....Brooklyn, N. Y.
WGAD Spanish Am. Schl. of Telegraphy, Ensonada, P. R.
WGAH New Haven Elec. Co. .....New Haven, Conn.
WGAJ W. H. Glass .....Shenandoah, Iowa
WGAK Macon Electric Co. .....Macon, Ga.
WGAL Lancaster Elec. Supply & Const. Co., Lancaster, Pa.
WGAM Orangeburg Radio Equipment Co., Orangeburg, S. C.
WGAN Cecil E. Lloyd .....Pensacola, Fla.
WGAQ W. G. Patterson .....Shreveport, La.
WGAR Southern American .....Fort Smith, Ga.
WGAT American Legion, Dept. of Nebr., Lincoln, Nebr.
WGAU Marcus G. Lumb .....Wooster, Ohio
WGAW Ernest C. Albright .....Altoona, Pa.
WGAX Radio Electric Co., Washington Courthouse, Ohio
WGAY North Western Radio Co. .....Madison, Wisc.
WGAZ South Bend Tribune .....South Bend, Ind.
WHAA State University of Iowa .....Iowa City, Ia.
WHAB Clark W. Thompson .....Galveston, Tex.
WHAC Cole Brothers Elec. Co. .....Waterloo, Iowa
WHAD Marquette University .....Milwaukee, Wisc.
WHAE Automotive Electric Service Co., Sioux City, Ia.
WHAG University of Cincinnati.....Cincinnati, Ohio
WHAH J. T. Griffin .....Joplin, Mo.
WHAK Roberts Hardware Co. .....Clarksburg, W. Va.
WHAL Lansing Capitol News .....Lansing, Mich.
WHAM School of Music, Rochester Univ., Rochester, N. Y.
WHAO F. A. Hill .....Savannah, Ga.
WHAP Dewey L. Otts. .....Decatur, Ill.
WHAQ Semmes Motor Co. .....Washington, D. C.
WHAR Paramount Radio & Elec. Co., Atlantic City, N. J.
WHAS Courier Journal & Louisville Times, Louisville, Ky.
WHAV Wilmington Elec. & Supply Co., Wilmington, Del.
WHAW Pierce Electric Co. .....Tampa, Fla.
WHAX Huntington Press .....Huntington, Ind.
*WHAZ Rensselaer Polytechnic Institute.....Troy, N. Y.
WIAB Joslyn Automobile Co. .....Rockford, Ill.
WIAD Ocean City Yacht Club .....Ocean City, N. J.
WIAE Mrs. Robt. E. Zimmerman.....Venton, Ia.
WIAF Gustav A. DeCortin .....New Orleans, La.
WIAH Continental Radio Mfg. Co.....Newton, Ia.
WIAI Heers Stores Co. .....Springfield, Mo.
WIAJ Fox River Valley Radio Supply Co., Neenah, Wisc.
WIAK The Stockman Journal .....Omaha, Nebr.
WIAP J. A. Rudy & Sons .....Omaha, Nebr.
WIAQ Chronicle Publishing Co. .....Marion, Ind.
WIAS Burlington Hawkeye-Home Elec. Co., Burlington, Ia.
WIAT Leon T. Noel .....Tarkio, Mo.
WIAU American Sec. & Sav. Bank.....Le Mars, Ia.
WIAV New York Radio Laboratories, Binghamton, N. Y.
WIAW Saginaw Radio & Elec. Co. .....Saginaw, Mich.
WIAY Woodward & Lothrop .....Washington, D. C.
WIAZ Electric Supply Sales Co. .....Miami, Fla.
WIAD Jackson's Radio Eng. Lab. .....Waco, Tex.
WIAG Huse Publishing Co. .....Norfolk, Nebr.
WIAJ Y. M. C. A. .....Dayton, Ohio
WIAK White Radio Laboratory.....Stockdale, Ohio
WIAM D. M. Perham .....Cedar Rapids, Ia.
WIAN Peoria Star & Peoria Radio Sales Co., Peoria, Ill.
WIAP Kelly-Duluth Co. .....Duluth, Minn.
WIAR The Outlet Co. .....Providence, R. I.
WIAS Capper Publications .....Topeka, Kans.
WIAT Kelley-Yawter Jewelry Co.....Marshall, Mo.
WIAU Yankton College .....Yankton, S. D.
WIAX The Union Trust Co. .....Cleveland, Ohio
WIAZ Chicago Radio Laboratory .....Chicago, Ill.
WKAA H. F. Paar & Republican Times, Cedar Rapids, Ia.
WKAC Star Publishing Co. .....Lincoln, Nebr.

WKAF W. S. Radio Supply Co. and Wm. Schack, Wichita Falls, Tex.
WKAH Planet Radio Co. .....West Palm Beach, Fla.
WKAK Okfuskee County News .....Okemah, Okla.
WKAL Gray & Gray .....Orange, Tex.
WKAN Alabama Radio Mfg. Co. .....Montgomery, Ala.
WKAP Dutee Wilcox Flint .....Cranston, R. I.
WKAQ Radio Corporation of Porto Rico, San Juan, P. R.
WKAR Michigan Agri. College.....East Lansing, Mich.
WKAS L. E. Lines Music Co. .....Springfield, Mo.
WKAV Laconia Radio Club .....Laconia, N. H.
WKAW Turner Cycle Co. .....Beloit, Wisc.
WKAX Wm. A. MacFarlane .....Bridgeport, Conn.
WKAY Brenau College .....Janesville, Ga.
WLAC North Carolina State College .....Raleigh, N. C.
*WLAG Cutting & Washington Radio Corp., Minneapolis, Minn.
WLAH Samuel Woodworth .....Syracuse, N. Y.
WLAJ Waco Electrical Supply Co. .....Waco, Tex.
WLAK Vermont Farm Mach. Co.....Bellows Falls, Vt.
WLAL Tulsa Radio Co. .....Tulsa, Okla.
WLAM Morrow Radio Co. .....Springfield, O.
WLAN Putnam Hardware Co. .....Houlton, Me.
WLAP W. V. Jordon .....Louisville, Ky.
WLAQ A. E. Schilling .....Kalamazoo, Mich.
WLAS Hutchinson Grain Radio Co.....Hutchinson, Kans.
WLAT Radio and Specialty Co. .....Burlington, Iowa
WLAV Electric Shop, Inc. .....Pensacola, Fla.
WLAW New York Police Dept.....New York City, N. Y.
WLAX Greencastle Community Broadcasting Station, Greencastle, Ind.
WLAY Northern Commercial Co. of Alaska, Fairbanks, Alaska
WLAZ Hutton & Jones Elec. Co. .....Warren, Ohio
WMAB Radio Supply Co. .....Oklahoma City, Okla.
WMAC F. Edward Page....Fernwood, Cazenovia, N. Y.
WMAF Round Hills Radio Corp. .....Dartmouth, Mass.
WMAG Tucker Electric Co. .....Liberal, Kans.
WMAH General Supply Co. .....Lincoln, Nebr.
WMAJ Drovers Telegram Co. .....Norman, Okla.
WMAK Norton Laboratories .....Kansas City, Mo.
WMAL Trenton Hardware Co. .....Lockport, N. Y.
WMAM Beaumont Radio Equipment Co., Beaumont, Tex.
WMAN Broad Street Baptist Church....Columbus, Ohio
WMAP Utility Battery Service .....Easton, Pa.
WMAQ The Chicago Daily News .....Chicago, Ill.
WMAR Waterloo Electrical Supply Co. .....Waterloo, Iowa
WMAT Paramount Radio Corporation .....Duluth, Minn.
WMAV Alabama Polytechnic Institute.....Auburn, Ala.
WMAW Wahpeton Elec. Co. .....Wahpeton, N. D.
WMAX K. & K. Radio Supply Co.....Ann Arbor, Mich.
WMAY Kingshighway Presby. Church.....St. Louis, Mo.
WMAZ Mercer University .....Macon, Ga.
WNAB Park City Daily News .....Bowling Green, Ky.
WNAC Shepard Stores .....Boston, Mass.
WNAD Oklahoma Radio Eng. Co. .....Norman, Okla.
WNAL B. J. Rockwell .....Omaha, Nebr.
WNAM Ideal Apparatus Co. .....Evansville, Ind.
WNAN Syracuse Radio Tele. Co. .....Syracuse, N. Y.
WNAP Wittenberg College .....Springfield, Ohio
WNAQ Charleston Radio Elec. Co. .....Charleston, S. C.
WNAR C. C. Rhodes .....Butler, Mo.
WNAS Texas Radio Corporation and Austin Statesman, Austin, Tex.
WNAT Lenning Bros. Co. .....Philadelphia, Pa.
WNAW Henry Kunsmann .....Fortress Monroe, Va.
WNAX Dakota Radio Apparatus Co. .....Yankton, S. D.
WNAY Ship Owners' Radio Service.....Baltimore, Md.
WNAZ Dr. Walter Hardy .....Ardmore, Okla.
WOAB Valley Radio .....Grand Forks, N. D.
WOAC Maus Radio Co. .....Lima, Ohio
WOAD Friday Battery & Elec. Co. .....Sycourney, Iowa
WOAE Midland College .....Fremont, Nebr.
WOAF Tyler Commercial College .....Tyler, Tex.
WOAG Apollo Theatre .....Belvidere, Ill.
WOAH Palmetto Radio Corp. .....Charleston, S. C.
WOAI Southern Equipment Co. .....San Antonio, Tex.
WOAJ Ervin's Electrical Co. .....Parsons, Kans.
KOAK Collins Hardware Co. .....Frankfort, Ky.
WOAL Wm. E. Woods .....Webster Groves, Mo.
WOAN James D. Vaughan .....Lawrenceburg, Tenn.
WOAP Kalamazoo College .....Kalamazoo, Mich.
WOAQ Portsmouth Kiwani's Club .....Portsmouth, Va.
WOAR Henry P. Lundskow .....Kenosha, Wisc.
WOAS Bailey's Radio Shop .....Middletown, Conn.
WOAT Boyd Martell Hamp .....Wilmington, Del.

WOAU Snowder Boiling Piano Co. ....Evansville, Ind.
WOAV Penna. National Guard .....Erie, Pa.
WOAX Franklyn J. Wolff .....Trenton, N. J.
WOAY John W. Wilder .....Birmingham, Ala.
WOAZ Penick Hughes Co. .....Stanford, Texas
WPAB Pennsylvania State College....State College, Pa.
WPAC Donaldson Radio Co. .....Okmulgee, Okla.
WPAD Wieboldt & Co. .....Chicago, Ill.
WPAF Peterson's Radio Co. .....Council Bluffs, Iowa
WPAG Central Radio Co., Inc. .....Independence, Mo.
WPAH Wisconsin Dept. of Markets.....Waupeca, Wisc.
WPAJ Doolittle Radio Corporation....New Haven, Conn.
WPAK No. Dakota Agricultural College....Fargo, N. D.
WPAL Superior Radio & Tel. Equipt. Co., Columbus, Ohio
WPAM Awerbach & Guettel .....Topeka, Kans.
WPAP Theodore D. Phillips .....Winchester, Ky.
WPAQ General Sales & Eng. Co. .....Frostburg, Md.
WPAR R. A. Ward .....Beloit, Kans.
WPAS J & M Electric Co. .....Amsterdam, N. Y.
WPAT St. Patrick's Cathedral.....El Paso, Tex.
WPAU Concordia College .....Moorhead, Minn.
WPAV Paul Tinetti & Sons.....Lauzlun, Mich.
WPAW Radio Installation Co., Inc....Wilmington, Del.
WPAX S-W Radio Co., J. R. Shumate, Jr., Thomasville, Ga.
WPAY Bangor Radio Laboratory .....Bangor, Me.
WPAZ Dr. John R. Koch.....Charleston, West Va.
WQAA Horace A. Beale, Jr. .....Parkersburg, Pa.
WQAB Southwest Missouri State Teachers College Springfield, Mo.
WQAC E. B. Gish .....Amarillo, Tex.
WQAD Whitball Electric Co. .....Waterbury, Conn.
WQAE Moore Radio News Station.....Springfield, Vt.
WQAF Sandusky Register .....Sandusky, Ohio
WQAH Brock-Anderson Elec. Eng. Co. .....Lexington, Ky.
WQAJ Ann Arbor Times-News.....Ann Arbor, Mich.
WQAK Appel-Higley Electric Co. .....Dubuque, Iowa
WQAL Cole County Tel. and Tel. Co.....Mattoon, Ill.
WQAM Electrical Equipment Co. .....Miami, Fla.
WQAN Scranton Times .....Scranton, Pa.
WQAO Calvary Baptist Church.....Peoria, Ill.
WQAQ West Texas Radio Co. .....New York, N. Y.
WQAR Press Publishing Co. .....Abilene, Tex.
WQAS Walter Prince Co. .....Muncie, Ind.
WQAT Radio Equipment Corporation...Westhampton, Va.
WQAV Huntington & Guerry, Inc. .....Lowell, Mass.
WQAW Catholic University .....Greenville, S. C.
WQAX Radio Equipment Co. .....Washington, D. C.
WQAY Gaston Music & Furniture Co....Hastings, Nebr.
WQAZ Greensboro Daily News .....Greensboro, N. C.
WRAA Rice Institute .....Houston, Tex.
WRAB Savannah Board of Public Education.Savannah, Ga.
WRAC State Normal School .....Mayville, N. D.
WRAD Taylor Radio Shop .....Marion, Kans.
WRAJ M. H. Pickering Co. .....Pittsburgh, Pa.
WRAM Lombard College .....Galesburg, Ill.
WRAN Black Hawk Elec. Co. .....Waterloo, Iowa
WRAO Radio Service Co. .....St. Louis, Mo.
WRAP Winter Park Elec. Construction Co., Winter Park, Fla.
WRAR Jacob C. Thomas.....David City, Nebr.
WRAU Amarillo Daily News.....Amarillo, Tex.
WRAV Antioch College.....Yellow Spring, Ohio
WRAY Radio Sales Corporation .....Scranton, Pa.
WSAA B. S. Sprague Elec. Co. .....Marietta, Ohio
WSAB Southeast Mo. State College, Cape Girardeau, Mo.
WSAC Clemson Agricultural College.Clemson College, S. C.
WSAH A. G. Leonard, Jr. .....Chicago, Ill.
WSAJ Grove City College.....Grove City, Pa.
WSAL Franklin Elec. Co. .....Brookville, Ind.
WSAS State of Nebraska.....Lincoln, Nebr.
WSAT Plainview Electric Co. .....Plainview, Tex.
WSAV Clifford W. Vick, Radio Construction Co., Houston, Tex.
WTAC Penn Traffic Co. .....Johnstown, Pa.
WTAS George D. Carpenter .....Elgin, Ill.
WTAU Ruegy Battery & Elec. Co.....Tecumseh, Nebr.
WTAW Agricultural & Mechanical College of Texas College Station, Tex.
WWAC Sanger Brothers .....Waco, Tex.
WWAD Wright & Wright, Inc. .....Philadelphia, Pa.
WWAH General Supply Co. .....Lincoln, Nebr.
WWAX Worman Brothers .....Laredo, Tex.
WWAY Marigold Gardens .....Chicago, Ill.

Canadian Broadcasting Stations

CFAC Radio Corporation of Calgary, Ltd., Calgary, Alberta
CFCA Star Publishing and Printing Co., Toronto, Ontario
CFCB Marconi Wireless Telegraph Co. of Canada, Ltd., Vancouver, B. C.
CFCD Canadian Westinghouse Co., Ltd. Winnipeg, Manitoba
CFCE Marconi Wireless Telegraph Co. of Canada, Halifax, Nova Scotia
CFCF Marconi Wireless Telegraph Co. of Canada, Ltd., Montreal, Quebec
CFCH Abitibi Power and Paper Co., Ltd., Iroquois Falls, Ontario
CFCI Motor Products Corporation, Walkerville, Ontario
CFCN W. W. Grant Radio, Ltd. .....Calgary, Alberta
CFCX The London Advertiser.....London, Ontario
CFPC International Radio Development Co., Fort Frances, Ontario
CFTC The Bell Telephone Co. of Canada, Toronto, Ontario
CFUC University of Montreal.....Montreal, Quebec
CFVC Roy Russell Brown....Courtenay, British Columbia
CFYC Victor Wentworth Odium....Vancouver, B. C.
CFZC Canadian Westinghouse Co., Ltd..Montreal, Quebec
CHAC Radio Engineers, Ltd. .....Halifax, Nova Scotia
CHBC The Albertan Publishing Co., Calgary, Alberta

CHCA Radio Corporation of Vancouver, Ltd., Vancouver, B. C.
CHCB Marconi Wireless Telegraph Co. of Canada, Ltd., Toronto, Ontario
CHCC Canadian Westinghouse Co., Ltd., Edmonton, Alberta
CHCF Radio Corporation of Winnipeg, Ltd., Winnipeg, Manitoba
CHCQ The Western Radio Co., Ltd., Calgary, Alberta
CHCS London Radio Shoppe.....London, Ontario
CHCX R. L. Silver.....Montreal, Quebec
CHCZ The Globe Printing Co.....Toronto, Ontario
CHFC John Millen & Sons, Ltd.....Toronto, Ontario
CHIC Canadian Westinghouse Co., Ltd., Hamilton, Ontario
CHOC Canadian Westinghouse Co., Ltd., Vancouver, B. C.
CHVC Metropolitan Motors, Ltd.....Toronto, Ontario
CHXC J. R. Booth, Jr.....Ottawa, Ontario
CHYC Northern Electric Co. .....Montreal, Quebec
CJBC Dupuis Freres .....Montreal, Quebec
CJCA The Edmonton Journal, Ltd., Edmonton, Alberta
CJCB James Gordon Bennett, Nelson, British Columbia
CJCD T. Eaton Co., Ltd. .....Toronto, Ontario
CJCE Vancouver Sun Radiotelephones, Ltd., Vancouver, B. C.

CJCF News Record, Ltd. .....Kitchener, Ontario
CJCG Manitoba Free Press Co., Ltd., Winnipeg, Manitoba
CJCH The United Farmers of Ontario, Toronto, Ontario
CJCI McLean, Holt & Co., Ltd., St. John, New Brunswick
CJCN Simons Agnew & Co. .....Toronto, Ontario
CJCS Eastern Telephone and Telegraph Co., Ltd., Halifax, Nova Scotia
CJCY Edmund Taylor .....Calgary, Alberta
CJGC London Free Press Printing Co., Ltd., London, Ontario
CJNC Tribune Newspaper Co., Ltd., Winnipeg, Manitoba
CJSC The Evening Telegram.....Toronto, Ontario
CKAC La Presse Publishing Co.....Montreal, Quebec
CKCB T. Eaton Co., Ltd. .....Winnipeg, Manitoba
CKCD Vancouver Daily Province.....Vancouver, B. C.
CKCE Canadian Independent Telephone Co., Ltd., Toronto, Ontario
CKCK Leader Publishing Co., Ltd., of Regina, Regina, Saskatchewan
CKCR Jones Electric Radio Co., St. John, New Brunswick
CKCS The Bell Telephone Co. of Canada, Montreal, Quebec
CKCZ Canadian Westinghouse Co., Ltd., Tecumseh, Ontario
CKKC Radio Equipment and Supply Co., Toronto, Ontario
CKOC The Wentworth Radio Supply Co., Hamilton, Ontario
CKQC Radio Supply Co. of London.....London, Ontario
CKZC Salton Radio Engineering Co., Winnipeg, Manitoba

WORLD WIDE WIRELESS

Radio Transmitters Increase 8,500 Per Cent.

AN increase of 8,500 per cent. in the number of radio transmitting stations of all kinds in the United States took place in the ten years ending last January. The total number of stations licensed on June 30, 1913, was 1,890, while on January 1, 1923, there were 21,065 stations recorded on the lists of the U. S. Department of Commerce. Of those stations, 544 were Class A broadcasters, 25 were Class B broadcasters, and 16,898 were amateurs. The complete table for the two dates is as follows:

Number of licensed radio stations on June 30, 1913, and on January 1, 1923.

	1913	1923
Broadcasting class A	.....	544
Broadcasting class B	.....	25
Amateur	1,312	16,898
Special amateur	3	201
Experimental	10	291
Technical and training schools	7	126
Point to point inland	14	167
Coast stations communicating with ships	64	39
Transoceanic	1	12
Ship stations	479	2,762
Total	1,890	21,065

Number of operators licensed during fiscal years 1913 and 1922.

	1913	1922
Commercial	1,832	3,136
Experimental and instruction	8	43
Cargo	1	14
Amateur, first class	1,075	4,530
Amateur, second class	766	4,390
Total	3,682	12,113

Since this table was compiled by the authorities in Washington, some minor changes have been made, principally in the list of Class A broadcasting stations. No figures are obtainable as to the number of receiving sets, as these are not required to be licensed, but of course they far exceed the transmitters in number, and are growing more numerous daily. It is estimated, however, that there are approximately 1,500,000 receiving sets in operation at the present time.

Would Broadcast in China

ACCORDING to one of the English daily papers in Shanghai, application has been made to the Chinese Minister of War for a "huchow" or permit to import amateur receiving sets, and erect and operate a broadcasting station or stations. There are a number of American manufacturers of radio and electrical apparatus, according to the Shanghai paper, backing the plans to give the country an efficient broadcasting service, and the co-operation of the U. S. consulate at Peking has been secured in negotiating with the authorities. Americans now in this country, however, who are familiar with the situation, say that the prospect is doubtful, as China is in a state of civil war, and in war time all amateur and popular radio is forbidden, there as in other countries.

Radio apparatus of all kinds is classified as "contraband of war" by the Chinese authorities, and its importation is strictly prohibited. So carefully is this rule and regulation enforced that some time ago a pair of telephone lineman's testing phones were seized by the Chinese customs officials on the ground that they were army field telephones, and it took considerable time to explain their use and secure their release. As long as this prohibition exists, it will be impossible to conduct broadcasting in China, for there would be no one to listen.

Movies by radio do not seem so far off when you inspect these samples of the transmission of photographs by radio. C. Francis Jenkins, of Washington, D. C., is the inventor

New International List

A NEW edition, the eighth, of the International List of Radio Telegraph Stations will be available soon. Copies may be had at 14 Swiss francs from the International Bureau of the Telegraph Union, Berne, Switzerland.

Mexico Repeats Marine Items

THE Mexican Government has inaugurated a new broadcasting service for mariners. Notices to mariners emanating from radio stations in America and Cuba, and vessels within their zone, are re-transmitted by six Mexican stations on both the Pacific and Gulf coasts.

England Sanctions Private Radio Enterprise

AN important announcement regarding the projected, but long-deferred imperial wireless chain was made by Premier Bonar Law in the House of Commons, on March 10. Replying to a question he said:

"In view of the developments in the science of wireless telegraphy and the other circumstances which have arisen since the late government decided upon a policy of a state operated wireless chain, it is not considered necessary any longer to exclude private enterprise from participation in wireless telegraphy within the Empire.

"The government has heretofore decided to issue licenses for the construction of wireless stations in this country for communication with the Dominions, colonies and foreign countries, subject to the conditions necessary to secure British control and for suitable arrangements for handling the traffic.

"At the same time the government has decided that it is necessary in the interests of national security that there should be a wireless station in this country capable of communicating with the Dominions, and owned and operated by private enterprise. A station of this kind will, therefore be erected as early as possible, and it will be available for commercial traffic as well as for service messages."

Army Radio Courses Now Are Standardized

A DEFINITE program of instruction in radio principles and practices has been laid down for the U. S. Signal Corps by a special board. Three courses are arranged, the Company Officers' Course, an Advanced Tactical and Administrative Course, and an Advanced Technical Course. Each takes a period of nine months for completion. In view of the radical changes that have taken place in the Signal Corps' relation to the other arms since the war, the new courses are of great importance. They will be relied upon in large measure to perfect the organization of the Corps into a scientific and technical body, responsible not so much for the actual operation of communication nets as for the furnishing of apparatus and training of special details from the other branches of the service.

Exhibit of Communication Methods

A COMPREHENSIVE exhibit of all methods of communication, including latest developments in radio telegraphy and telephony, is being collected by the U. S. National Museum at Washington. The U. S. Signal Corps is co-operating with the Museum in developing a series of models illustrating the runner, the mounted messenger, the heliograph, the Postal Service, wire communications and finally, the history of radio. Many of the exhibits will consist of historic apparatus once used in this country and abroad.

Radio on Lightship 106

LIGHT VESSEL 106, which will be anchored off Nantucket Shoals, Mass., is being completed by the builders at Bath, Me., where it was launched last October, and will shortly take its post at sea. Radio fog signal devices of the latest type are being installed in the ship, which will be the first lightship of the lighthouse service to be equipped from the start with this apparatus. The ship will be one of the most completely equipped off any coast and will have not only the most modern radio and transmitting apparatus, but also a powerful whistle, a submarine bell, and a brilliant automatic flashing light.

Navy Closing Lake Stations

NINE radio stations on the Great Lakes have been ordered closed by the U. S. Navy, pending final determination of their disposition. In the main, these were stations put in commission during the war, and since the necessity for them passed, they have been operated on a temporary basis. One of them, at Cleveland, Ohio, now will be used only for air mail work. According to Secretary of the Navy Denby, the stations now serve no purpose in connection with the efficiency of the fleet, and hence cannot be operated by the Navy any longer. They will be shut down while it is determined whether to lease them for private operation or transfer them to some other department of the Government.

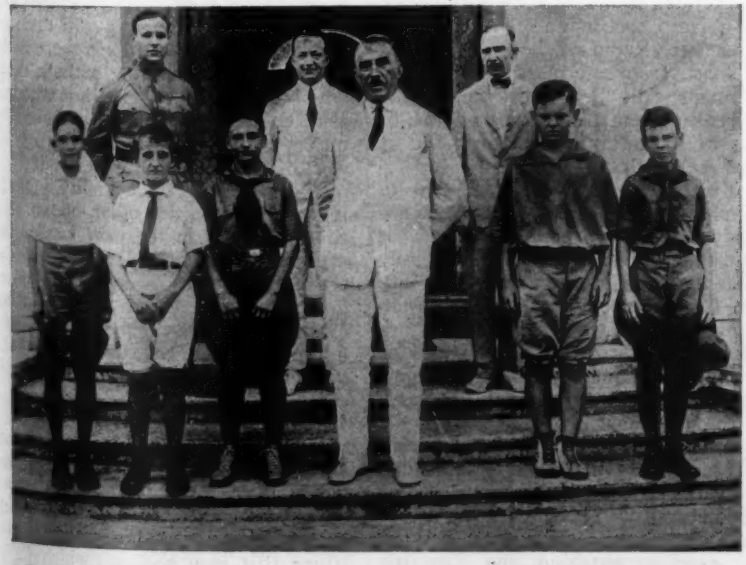
New Commercial Stations

THE radio station at Kotonou, West French Africa, now is in operation on 600 meters with a range of 300 miles. The transmitter is an S. F. R. Spark set. General public messages are handled between the hours of 8 to 11 and 14 to 17 o'clock, Greenwich mean time. The call is FKO.

CRK, Praia, Cape Verde Islands, is working on 600, 800, 1,000 and 1,530 meters, from 10 to 22 o'clock, Greenwich mean time. It has a Marconi transmitter with a range of about 400 miles.

Radio Exports Increase

EXPORTS of wireless telephone and telegraph apparatus from the United States during 1922 were more than three times as large as they were in 1921. The total value for last year was $3,214,098, compared with $1,010,-891 in 1921. Of the 1922 total, $2,891,799 consisted of radio apparatus, the rest being telegraph material.



Boys in the Philippine Islands are potential operators and broadcast fans. Here are the first boys there to make and operate their own sets, with Governor General Leonard Wood, who congratulated them on their skill

Engine Service by Radio

THE radio operators on board ship have often been called upon to transmit messages dealing with human illness on board their vessels, but it is very seldom if ever they have to fill the ether with appeals for a diagnosis of engine trouble, yet that has been what the S. S. *Jangvar* recently did. This ship uses Diesel engines, which take a special kind of oil as fuel. On her way from the Mediterranean to New York the vessel's fuel tanks ran dry unexpectedly. By using her wireless it was found that the nearest port where oil could be obtained was Ponta Delgada, but that there only a heavy oil, much heavier than Diesel oil, could be had. Could this oil be burned in the Diesel engine and if so, what, if any, alterations would have to be made? was the problem faced by the chief engineer of the *Jangvar*. An appeal for advice was sent to the Diesel department of the Morse Drydock & Repair Co., by radio. Instructions were sent back, and the *Jangvar*, which otherwise might have had to wallow helplessly in the seas until a ship came along and towed her to New York, was able to continue her journey under her own power.

French Radio Letters

FRANCE has introduced a new type of "radio letter" service for communication with her colonies, entailing the use of both the mails and the radio telegraph. The French radio letter must be printed plainly, and forwarded to the transmitting station by mail. There it is sent by radio to the appropriate receiving station, which places the message in its local mails for delivery in that manner. The result is a considerable saving of time over the all-mail route, and at a cost of less than the full radio rate.

San Francisco Show

SAN FRANCISCO is all set for the radio and electrical exposition to be held April 3 to 8, under the auspices of the American Radio Exposition Company of New York. The Exposition Auditorium has been secured for the show, which has the endorsement of the Pacific Radio Trade Association, San Francisco Electrical Development League, Electrical Contractors and Dealers' Association of San Francisco, and the California State Association of Electrical Contractors and Dealers. The show will be conducted in the same manner as was the very successful New York exhibition of last December, a feature of which was the prohibition of loud speaker demonstrations and the use of sound-proof booths for that purpose. It is hoped to make the exhibition an annual affair.

Radio Revolution Not Yet Here

Power-Line Broadcasting Has Many Disadvantages Which Must Be Overcome Before Any Advantage Is Had Over Present Method—Many Reasons Why Radio Broadcasting Will Always Have a Strong Appeal

By Carl Dreher

"WIRELESS Has Been Revolutionized Over Night," reads a headline on the first page of a radio newspaper supplement. "What!" the reader may exlaim, "Have they discovered another variation of Armstrong's super?" The invention in this instance, however, is not so much in the receiver as in the medium between the broadcasting station and the listener. It's wired wireless—the system whereby the oscillations of the radio set, instead of being scattered to all points of the compass through space, are injected into a wire network. The article under the excited headline is a report of preliminary research done by an electric lighting company with the ultimate aim of selling a news, musical and educational service to its consumers by putting modulated radio frequency waves onto the electric light and power wires.

Revolution is a much-abused word. Nowhere has it been more abused than in the radio field during the past year or so, since broadcasting took hold of the public imagination. For one thing, so many of the revolutions seem to center around old ideas. This matter of line radio, for example, is by no means new. Major-General George Owen Squier is said to have invented it. He has done considerable work in this field, no doubt interesting and valuable work, for General Squier's eminence in scientific circles is unquestioned. Until an investigator's patents have been adjudicated, however, it is wise to hold one's judgment in abeyance in such matters. Other men have worked in this field. The public, of course, usually has little conception of the painful steps by which an art progresses, the interaction of different men's labors, the difficulty of assigning just credit to all the workers in a complicated engineering project. It is the same, of course, in all the applications of science. The public thinks M. Coué invented auto-suggestion. Muensterberg, who wrote about it at great length twenty years ago, is dead and forgotten—and Muensterberg never claimed the invention of this useful, but strictly limited method of psychiatry. Other men, he knew, antedated him. Without wishing to draw a parallel between the case of wire radio and this one, we should take the lesson to heart as showing the general attitude which one should take in common fairness. Similar instances might be cited without number. A number of contemporary radio men honestly believe that they are—or rather, each one thinks that he is—the inventor of the spider web inductance. But a fully-developed spider web coil is photographed in Zenneck's book on wireless telegraphy, written in 1908! Who invented the construction is not stated, but certainly the people who think they invented it in 1920 are in need of a little paging of old textbooks.

Leaving aside, however, the question of invention, it may be worth while to analyze the present situation in radio briefly, in order to forecast the result of a serious pushing of the wired radio idea by well capitalized interests, if such a development comes about. The proponents of the idea claim that it will appeal to the public because receiving apparatus can be made comparatively simple. As the broadcasted energy is sent out on wires, less attenuation or weakening of the signals may be expected than when the waves are flung off into space, on the same principle as that it takes several hundred kilowatts to telegraph over the ocean commercially by radio, and a comparatively small wattage when a cable is used. Thus, with a broadcasting transmitter shooting jazz into the lighting mains, a loud speaker may in all likelihood be operated by a single tube connected to a lamp socket through a suitable condenser. Radio receiving is changed, in short, from a problem in what the Germans call "Schwachstromtechnik"—weak current technique, to more or less of a power proposition. But is that really what people want?

Most of us have forgotten how to amuse ourselves. Plenty of people are ready to sell us amusement, but is it quite the same thing? It is really amazing what ponderous efforts are put forth to preserve the public from being bored. Enormous industries are based on the need of the people for diversion and their incapacity for getting it unassisted. In all this the rôle of the individual is purely passive. It is like going to an osteopathic physician in order to be massaged and mauled around, in place of taking one's exercise naturally. The movies are a case in point. The average man sits out an evening watching the fantastic struggles and exploits of the hero. He never thinks of having any adventures of his own. He is resigned, apparently, to the routine of a drab and restricted existence, relieved only by injections of industrialized and standardized entertainment. And, of course, the farther one goes along this road the more incapable one becomes of turning back. It has come to the point where an individual who still tries to be self-sustaining in his diversions runs the risk of being considered slightly abnormal.

Nothing could be less in keeping with the traditions of a nation which is supposed to foster individual enterprise and initiative. And in fact there is a good deal of restlessness under a system of living whose tendency is to make people act alike, and which, as the machinery of existence becomes more complex, restricts the activity of the individual more and more. Now what has this argument to do with radio?

Radio has been to a considerable extent a release for the energies which in most people find no adequate outlet. To that factor a great part of its present popularity may, I think, be ascribed. Radio, for a good many people, is not merely a passive listening to this soprano or that lecturer; it is an adventure. Building a set is a part of the adventure, to people many of whom have never done any previous handiwork beyond hanging a screen door. They have their difficulties and failures, but in the long run they are having a good time. Then there is the lure of distance work, for both those who build their own and those who buy sets complete. People without the means to travel get something of the zest of being footloose, even if it is only a shadow of the actuality, in hearing stations at the other end of the country. And in the very fact of the art's incomplete development and the certainty that broadcasting will undergo, within the next decade, many changes and developments now only dimly foreshadowed, amateurs of radio realize once more the impulses and compensations of pioneering.

For every listener who is interested only in the content of broadcasting and doesn't want to hear a word about the works inside of the box, there is another who insists on knowing all about it, adding some radio-frequency and trying that new hook-up which Jones says is "the berries." There is room for everyone. For the former class—

wired wireless, if and when it develops. For the latter—radio.

What has happened, in effect, is the infection of a large percentage of the newcomers in radio with the same spirit that animates the old style wireless telegraph amateurs. The code work, as a matter of fact, is a special thing. If one is not a good operator, one is none at all; and to become a fast operator is at least as hard as to become a competent stenographer. People are unlikely to do it in large masses—speaking here in terms of national population—except under the pressure of having to earn a living. This factor has restricted and will continue to restrict the number of code enthusiasts and transmitter men and so on. When radio telephone broadcasting came the field of interest in radio widened enormously. The man in the street became eligible for membership. If the new game lacks some of the spirit of freemasonry which ties together the comparative few who know the code, it makes up for that in the greater intimacy and humanism of communication by the spoken word, and in the superior interest of telephone broadcasted material over the bulk of telegraphed matter.

It seems clear, on these psychological and biological grounds, that radio has a field of its own, and that high frequency on wires will not oust high frequency in space, any more than high frequency in space supplanted low frequency on wires. Wires have certain inherent physical qualities, and space has other inherent qualities, and applications in each field derive exclusive advantages therefrom. We may analyze some of these characteristics on a technical basis. Looking at the matter electrically, is it certain that even in point of reliability wired radio can win hands down from the etheric brand? Some conjectures are possible. Presumably in the carrier system on wires the intention is mainly to exploit the rural field. Urban radio broadcasting, it is clear already, can be developed into a sensibly perfect proposition, on the level of the best public utility services. Long transmission lines, as everyone knows who has lived in the country, have their troubles. An antenna a few hundred feet long can be put up to withstand anything short of an earthquake, but when the stretch is a few hundred miles, there is apt to be a weak spot or two along the line—and high tension finds out weak spots. It is a rare electric light transmission that does not abandon its consumers to kerosene and candles during a heavy blizzard or a violent lightning storm. Sometimes the interruption is for a few minutes, sometimes for days. At these times, when the radio may be expected to hold up much more persistently, at least under winter conditions, the wire broadcast is apt to run behind. The same may conceivably be the case in time of public danger or disaster.

Then the matter of static. Lightning is no respecter of wire lines. Some of the best minds in the electric transmission field are still working on improvements in lightning arrester practice. It is hardly conceivable that the forces which occasionally burn out generators and shatter insulators will leave the radio frequency transmission on the same conductors unaffected. The amount of carrier current that can be conveniently injected is after all limited by commercial considerations, while lightning, though brief, runs into inordinate horsepowers. And here the very advantage of wire transmission may prove a drawback, for while with space broadcasting under proper transmitting conditions (adequate power, etc.) nothing short of local lightning should break up a concert, the wires may bring a storm near, in the electrical sense, where the greater attenuation of space radio would be a protection.

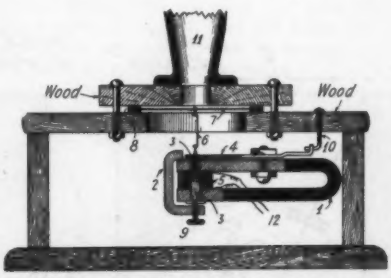
A final consideration along the same lines involves the question of possible effects due to the broadcasting current having to share the wires with the commercial frequency power. Just as space radio has to share the ether with what Professor Pupin calls the wireless stations of God, which send their messages in static, so wire radio will be subject to possible disturbances originating in such unromantic machinery as heavy motors, fed from the same wires, and quite capable of releasing in their turn impulses capable of affecting tuned circuits. Any observer who has used the wire lines with condenser plugs as an antenna substitute, particularly on direct-current distributions, will appreciate the possibilities of serious interference from such sources. In advance of demonstration over a suitable period and under the variety of conditions encountered in electric power practice, one may take with considerable reserve the prophecies that in wired wireless nothing will be heard at the receiver but what is sent out from the transmitter.

In short, the radio revolution may not be quite as red as expected.

Loud-Speaking Receiver

AN amplifying receiver having remarkable quality of tone and good volume may be easily constructed as illustrated in the accompanying diagram. The magnet (1) is from an ordinary telephone receiver. Soft-iron cores (3) pass through the holes in the ends of the magnet, the lower core forcing in, and the upper given 1/64 clearance. A strip of 1/16 cold-rolled steel ½-inch wide (4), is clamped to the upper leg of the magnet as shown. The end of this takes the stem of the upper core, which may be forced in and held by solder. The coil (5) form-wound with No. 36 double silk covered wire is put in place, after which the cores are inserted, having a gap between their smooth and accurately-faced ends of about .010-inch which may be adjusted to almost nothing by means of the screw (9) and clamping-yoke (2).

The diaphragm of mica, about .010-inch thick, is held between rubber rings (8) which may be large size fruit-jar rings, as shown, by means of screws clamping the upper and lower wooden parts together. A small stud, preferably of aluminum, takes the upper end of the link (6), which in conjunction with hook (10) supports the mechanism. The hook (10) should be located at such a distance from the link that the latter is subjected to about four-ounce tension. In operation the gap should be so adjusted that the pole-faces are all but touching during the loudest sounds. For radio work it may be necessary to use a step-down transformer in case the current from the tubes is of too high voltage and of little volume.



Constructional view of the loud-speaker

1, magnet from 'phone receiver; 2, brass clamping yoke; 3, soft iron cores; 4, cold-rolled strip; 5, wire coil. No. 36 double silk; 6, connecting link; 7, mica diaphragm, approx. .010"; 8, rubber gaskets (jar-rings); 9, gap adjusting screw; 10, supporting hook; 11, amplifying horn; 12, leads to coil

Excellent Results with Crystal Receiver

By PAUL BORTH

RECENTLY I made up a set of the 100-mile crystal receiver type described by Carl Dreher, in the December issue of THE WIRELESS AGE. I live in a suburban section of Chicago (Mount Claire) and use an aerial about 18 or 20 feet high. The aerial is about 100 feet long, single wire.

With the outfit described, using a selected crystal, I have received Davenport, Ia. (WOC) about 160 miles, and WWY, Detroit, 250 miles. One evening I heard very faintly KDKA. I did not hear the station letters, but I distinctly heard the announcer say "Westinghouse" and "Pittsburgh." I have also heard station WGY, or WGI, I don't know which, because the letters I and Y sound nearly alike at such a distance over radio. Here in the vicinity of Chicago we haven't much of a chance to experiment with faint signals, as KYW, WMAG and WDAP are going practically all evening.

WGY, Schenectady, if it was that station I heard, is approximately 700 miles from Chicago and KDKA, Pittsburgh, is about 450.

The Neutrodyne Receiver

A New Principle in Radio-Frequency Reception for Neutralizing Capacity Effects of Tubes—True Radio-Frequency Amplification Apparently Obtained

By Abraham Ringel
Member, Institute Radio Engineers

EXPERIMENTERS and engineers have proposed various arrangements for getting rid of disadvantageous coupling effects in radio receiving circuits. Professor L. A. Hazeltine, of Stevens Institute of Technology, announced at a meeting of the Radio Club of America in Columbia University, the completion of his receiving set for this purpose. Professor Hazeltine, traced the steps by which he claims to have finally eliminated the capacity coupling in the tube. He then demonstrated a number of receivers which embodied his scheme and called as witnesses a number of prominent amateurs who testified to the results obtained.

Prof. L. A. Hazeltine (at left) demonstrating his Neutrodyne Receiver to radio engineers at Columbia University

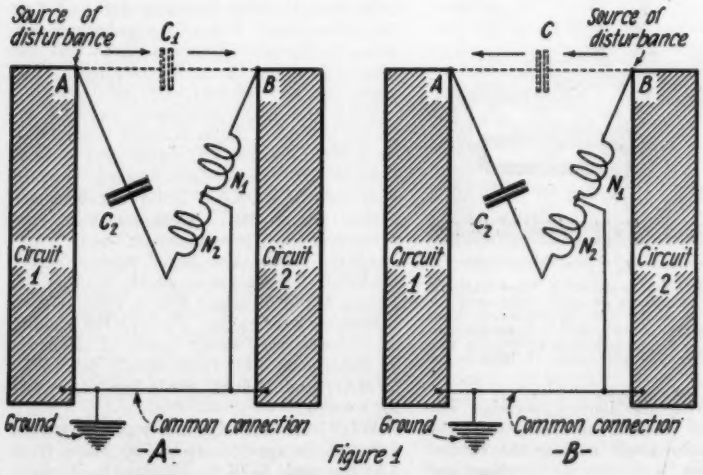
Professor Hazeltine named his amplifier the "Neutrodyne" because in it he attempts to neutralize the capacity couplings of the amplifier tubes. It consists essentially of a tuned amplifier, which is stable, neutralization being effected by small capacities connected from grid to grid of successive radio frequency tubes. No potentiometer is necessary—and the tuning is said to be quite simple.

It is equally effective at short and long wave lengths. Some performances of a four-tube amplifier which is illustrated in figure 11 are as follows: (1) At broadcast wave lengths, as an instance, it regularly receives Fort Worth, Texas, which is at 417 meters and 2,000 miles away, while WEAF is working in New York City on 400 meters and only one mile away. (2) At amateur wave lengths: In one evening two prominent amateurs located in New York, both using similar sets, each received amateur stations in all districts. No external oscillator was necessary, CW being received merely by making the detector tube oscillate.

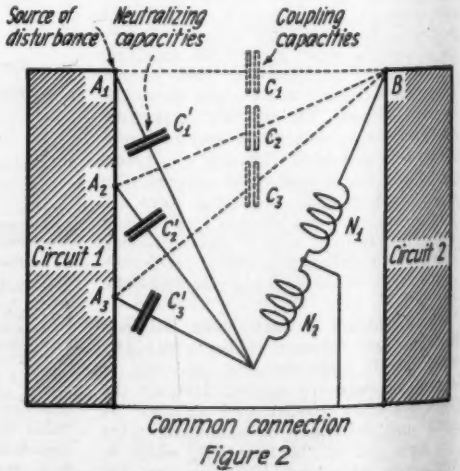
Capacity Coupling and How to Neutralize It

Before going on to the description of various practical neutrodyne hook-ups, the writer believes it best to explain the action of capacity coupling and the general method of neutralization.

Figure 1 illustrates the general method of neutralizing capacity coupling. There are two circuits, I and II both connected to some common point, usually ground. If circuit I contains radio frequency energy, some of it is bound to get into circuit II because of the capacity between I and II. This capacity is represented by C, and shown connected by dotted lines, which indicates that there is no other electrical connection. Current will flow from A to B through C, in the direction of the arrows. To neutralize this action, the arrangement A-C_3-N_3-N_4-B is introduced, with a lead taken from the junction of the coils to the ground. The coils N_3 and N_4 are coupled closely to one another. Current also flows from A through C_3 and N_3 to ground. This current induces in N_4 a voltage of such direction as to create a current which opposes the current coming through C_1. In order to obtain complete neutralization, Professor Hazeltine has shown that the following relation must hold:



Prof. Hazeltine's method of neutralizing capacity coupling



Neutralizing capacity coupling between a number of points

$$\frac{N_1}{N_2} = \frac{C_3}{C_1}$$

Where N_1 and N_2 represent the number of turns on the coils, this expression is also correct when circuit II is the source of the disturbance, as shown in figure 1B. The capacities C_1 and C_3 may be made equal, in which case, N_1 and N_2 would both have the same number of turns. If N_2 has four times as many turns as N_1, C_3 would be one-fourth as large as C_1.

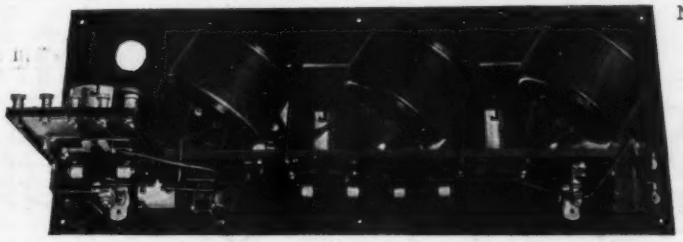
If there is coupling between a number of points of circuit I and point B of circuit II, as shown in figure 2, a similar method is used to neutralize these capacities. Here C_1, C_2 and C_3 are the coupling capacities, and C'_1, C'_2 and C'_3 the neutralizing capacities. Only a single coil need be used.

Figure 3 illustrates a previous practical application of this neutralization in an old Navy type receiver. Trouble was experienced in getting zero coupling between primary and secondary windings of the receiver—because of the capacity. This was eliminated by making a secondary with two windings only one of which was useful in applying the received signal to the detector. The neutralizing winding acts as one-half the inductance and provides neutralizing capacity, through its capacity to primary.

Capacity Coupling in Vacuum Tubes and Its Neutralization

Due to the internal capacity of the tube the amplified energy in the plate circuit may be fed back through this capacity to the grid and re-amplified, etc., until a state of oscillation is reached if the plate is almost in tune with the wave lengths of the grid circuit. The ordinary regenerative receiver which employs plate tuning (see figure 4), is a very common example of this. In radio frequency amplifiers we are likely to encounter in addition coupling capacities between various stages as shown in figure 5. Thus the radio frequency amplifier is not a true amplifier, since we reduce the actual amplification factor of the tube in order to stop oscillation, but depend on regeneration for proper functioning.

In applying the methods of figure I to neutralize the grid-plate capacity, we obtain circuits of figure 6A and 6B. The method of 6A corresponds to that of figure 1A and of 6B to figure 1B. In the former, the neutralizing winding is coupled to the grid coil and the neutralizing capacity connected to the plate, which is the source of the disturbance. In the latter case, the neutralizing winding is coupled to the existing plate coil and the neutralizing condenser connected to the grid. The reader should trace these circuits himself and compare them with figures 1A and 1B in order to satisfy himself absolutely as to their identity. Of course the equation given above still applies. It is important to have the windings in the proper direction so that neutralization of capacity coupling is obtained. This condition results when the points A and B are of opposite polarity.



A standard type of neutrodyne receiver

The circuits of figure 6A and 6B illustrate the essential methods used by Professor Hazeltine in his "Neutrodyne" amplifier. But Professor Hazeltine was not satisfied to use additional coils and devised a method whereby no new windings would have to be employed. The transformer itself acts as the entire neutralizing winding—both primary and secondary being employed; the junction of the coils, which is connected to ground being in one case directly connected to the negative filament battery and in the other through the B batteries to the same point. Figures 7A and 7B show how this is actually accomplished in a radio frequency amplifier. In one case a neutralizing capacity C_3 of the necessary value ($C_3 = \frac{N_1 C_1}{N_2}$) is connected between successive plates. In this case, if N_1 and N_2 are of an equal number of turns, with proper polarity of windings, the neutralizing capacity C_3 would be of the same value as C_1. If the transformer is step-up, say N_1 has four times as many turns as N_2, the neutralizing capacity would be four times as large as C_1—the grid to plate capacity. In the average amplifier tube the value of C_1 is about 6 micro-microfarads; so that C_3 would then be 24 micro-microfarads. In the case of figure 7B, C_3 is likewise determined by N_1 C_1. But here, N_1 is the plate coil and N_2, the grid coil. Thus if we have a step-up ratio of 1 to 4, C_3 would be only one-fourth as great as C_1, or in the case of the UV-201, about 1.5 micro-microfarads. C_3 is here connected between successive grids.

On comparing figure 7 with figure 1, the reader will convince himself of the essential similarity.

Practical Neutrodyne Hook-ups

From the theoretical considerations just given, it is evident that in order to stabilize a radio frequency oscillator it is simply necessary to connect neutralizing condensers between successive grids of the amplifier—or successive plates. The polarity of the windings should be properly made in order to produce neutralization—and the capacities themselves adjusted to the correct value for neutralization. Professor Hazeltine prefers to use condensers between grids rather than plates because he finds it easier to produce a condenser of 1.5 micro-microfarads than one of 24 micro-microfarads (since he uses a step-up ratio of 1 to 4 in his transformers). This method of stabilizing may be used with ordinary radio frequency transformers, where the ratio of turns is about 1 to 1. The neutralizing capacity connected either between grids or between plates is then 6 micro-microfarads.

There is no advantage, however, in using ordinary radio frequency transformers with their large effective resistance, since they will not function properly without regeneration. With a tuned radio frequency amplifier as here described, the adjustments are quite simple and the selectivity is greatly increased, because of the lower resistance of the coils. The wave length range with a transformer is limited, but with a tuned circuit, a very broad band may be covered, depending on the size of the coils and condensers. With the circuits and coils described here, the range is from about 180 to 500 meters, with practically equal amplification over the entire band. Profes-

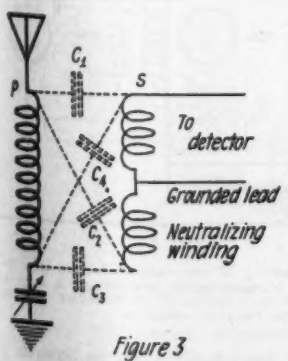


Figure 3

Neutralizing winding in the secondary—used in an old type of Navy receiver

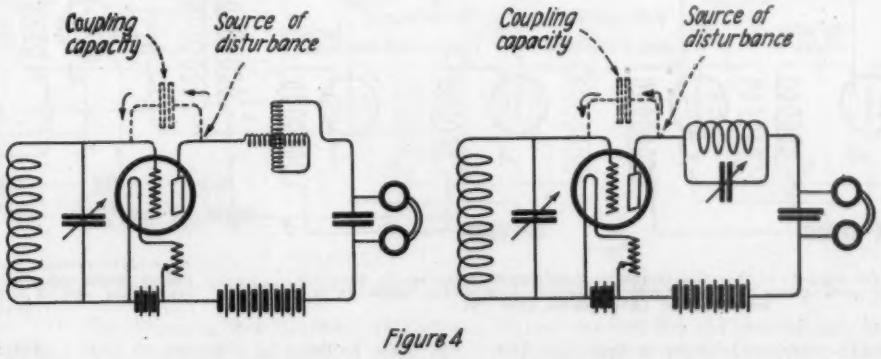


Figure 4

Illustrating capacity coupling in tuned plate regenerative vacuum tube circuits

sor Hazeltine estimates that he can obtain a voltage amplification of about 11 per stage, which is beginning to compare quite favorably with the audio frequency amplifier—where we can get about 20 times per stage.

Figure 8 illustrates a practical 3-tube

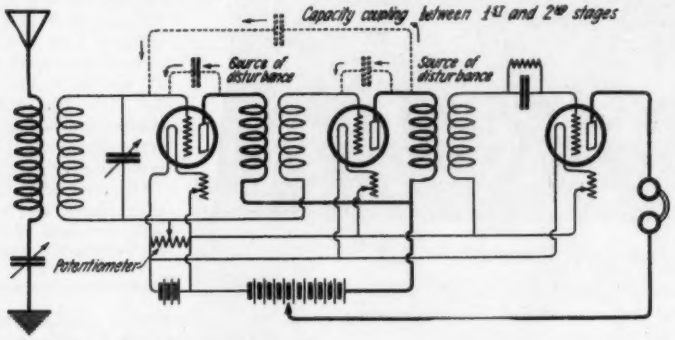


Figure 5—The radio frequency amplifier actually consists of a number of regenerative tube circuits coupled to each other. Regeneration is caused by the capacity coupling between grid and plate

neutrodyne receiver, which consists of two stages of tuned radio frequency amplification and a regenerative detector. The radio frequency coupling coils or transformers are described in figure 13. It will be seen that the transformer T is composed of two coils very closely coupled. The primary consists of about 13 turns of No. 24 D.S.C. wire wound on a tube 2¾ inches in diameter, which is inside the secondary coil. The latter consists of 55 turns of No. 24 D.S.C. wire wound on a 3-inch tube. The tuning condenser has a maximum capacity of about .0005 microfarads and is of standard 11-plate type. It will be noted that the antenna circuit is not tuned at all, but it is so closely coupled to the secondary that the aerial circuit is thus brought into resonance.

Regeneration may be employed with this hook-up. An ordinary plate variometer in the plate circuit of the detector tube does the trick very nicely. It is especially advantageous in receiving short wave C.W.—no external heterodyne being required. All the tubes may be hard, but a soft detector tube can be used to advantage.

The stabilizing condensers, which would have a capacity of only 1.5 micro-microfarads appears to present some difficulty. One ingenious method of obtaining such a small condenser is shown in figure 12. The wires connected to the grids are insulated and butted together, leaving a gap of about ¼ inch. A small metal tube is slipped over the wires, and the capacity is adjusted by sliding the tube until neutralization is obtained. The last process is a matter for the individual experimenter and will require a little care to secure the correct capacity. But once done, it will be unnecessary to readjust unless an altogether different type of tube—with different grid to plate capacity—is used. The tube should then be tied down so that it cannot be moved or disturbed.

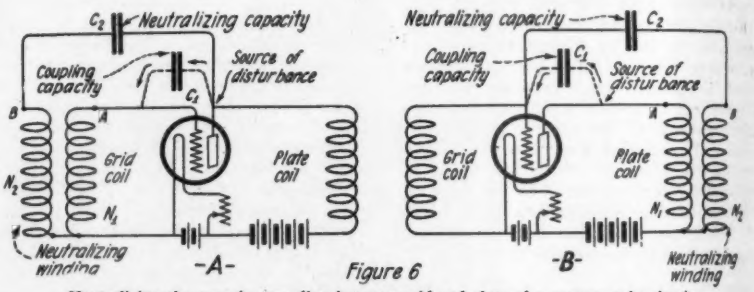


Figure 6

Neutralizing the capacity coupling between grid and plate of a vacuum tube circuit. A—Neutralizing winding coupled to grid coil. B—Neutralizing winding coupled to plate coil

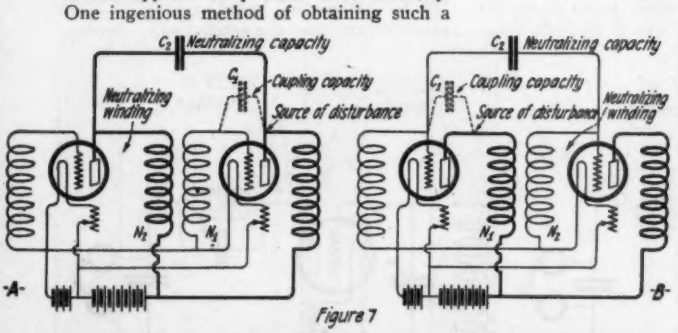


Figure 7

Using the windings of the radio frequency transformers themselves to neutralize capacity coupling in a tube and prevent oscillation. Neutralizing condensers used between plates (A): between grids (B)

TUNING

In tuning, changing one adjustment does not materially affect the others; in other words, the adjustments are altogether independent of one another. Ordinary methods of tuning do not apply here. In an ordinary receiver, the antenna circuit has a rather broad tuning. But in the neutrodyne, the antenna, or rather the first tuned circuit is the most sharply tuned of all.

In order to bring in a station, all dials are set at approximately the same position (since the coils are alike). The last condenser is adjusted first, thus tuning the detector circuit. The second stage of amplification is then tuned, and finally the first. A little practice on the local transmitters will give the experimenter some idea as to the relative positions of the dials. If the positions for a 400-meter station are, let us say, 70° on the last dial, 68° on the second dial and 72° on the first, this relative position will be preserved to a fair degree. So that if a distant station at 380 meters is desired, the last dial will be reduced to approximately 65°, the next to 63°, and the first will be about 67°. The adjustments are then slightly altered until the best results are obtained. Once these wave lengths are logged, it is merely necessary to set the condensers at the recorded values and the circuit will be in tune.

For C.W. reception, the plate variometer is tuned in the usual fashion until a beat note of the desired pitch is obtained. The beat note is altogether independent of the other adjustments, except the detector tuning which of course determines the frequency of oscillation together with the position of the plate variometer. The first two dials, which control the radio frequency tuning merely vary the intensity of the received signal. Only when all the circuits are absolutely in tune, is there a slight change in the beat note.

In the neutrodyne the amplifier will not oscillate, so the inventor claims. No adjustments, it is said, that can be made, except perhaps that of the stabilizing condensers, will produce this undesirable condition. A stabilizing potentiometer is of no value—since there is no need for one. The tuning of the neutrodyne is not as sharp as a standard regenerative receiver—therefore no vernier adjustments are required. The

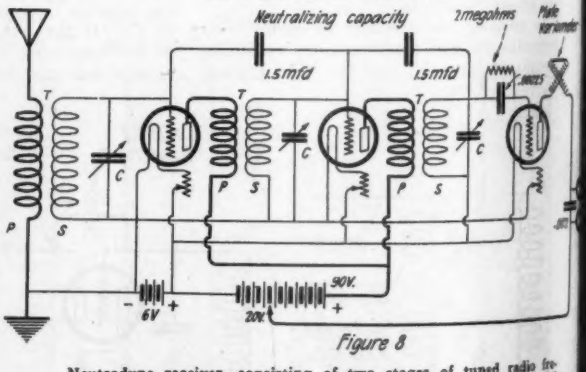


Figure 8

Neutrodyne receiver, consisting of two stages of tuned radio frequency amplification and a regenerative detector. T is a special transformer with 13 turns on primary, 55 on secondary. C is an 11-plate variable condenser

panel, therefore, need not be shielded. All the circuits here given show only two stages of radio frequency amplification. It is inadvisable to add another stage because of the difficulty in preventing stray couplings between the last stage and the first two stages, unless the last stage is thoroughly shielded. It is also very hard to balance or rather neutralize the grid-plate coupling of the third stage, whereas a balance is very easily secured with two stages—adjustment of the stabilizing condensers being fairly broad.

Another point that cannot be overlooked in the neutrodyne amplifier is the inductive coupling between the various stages, due to the magnetic field of the coils. This is settled by arranging the coils as shown in figure 14. The lines of force of the magnetic field of one coil will then be parallel to the windings of an adjacent coil—and thus no voltage will be induced in the latter. This is shown in the rear view photo of the receivers demonstrated by Professor Hazeltine before the Radio Club of America.

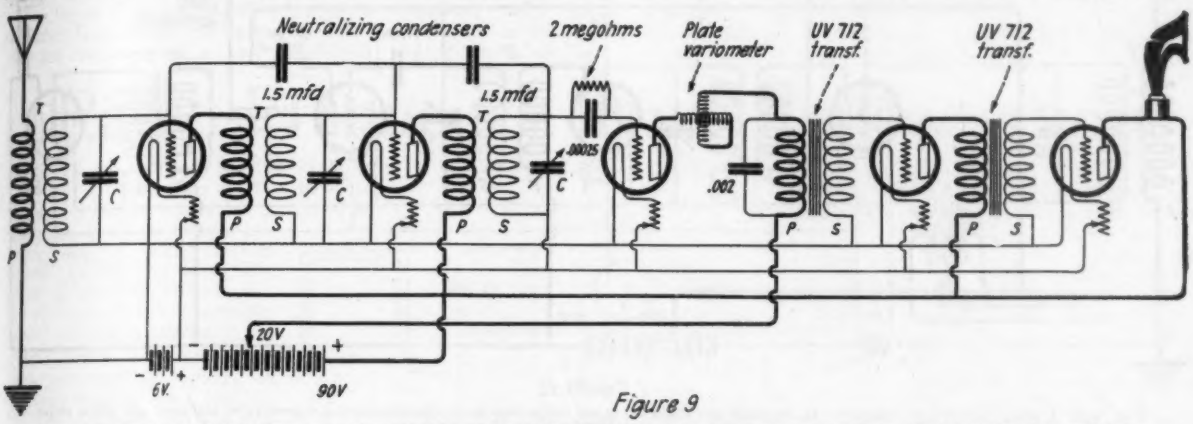


Figure 9

Neutrodyne receiver containing two steps of tuned r. f.; a regenerative detector and two steps a. f. amplification. T—Special transformers having 13 turns on primary and 55 turns on secondary

The tubes used were amplifier tubes and exceptional results were obtained. On the detector alone, amateurs in all districts of the United States were logged in New York. Broadcast stations in Texas, Kansas City, Minneapolis, Davenport were also heard. With a loud speaker and two stages of audio frequency amplification, Atlanta, Georgia was quite loud with only a ground connection and no aerial at all.

3-Tube Reflex Neutrodyne

Because it is unnecessary to apply a positive bias to the grids of the amplifiers in order to stabilize them, the neutrodyne lends itself admirably to reflexing. The main features of reflex circuits were described by the writer in an earlier issue of

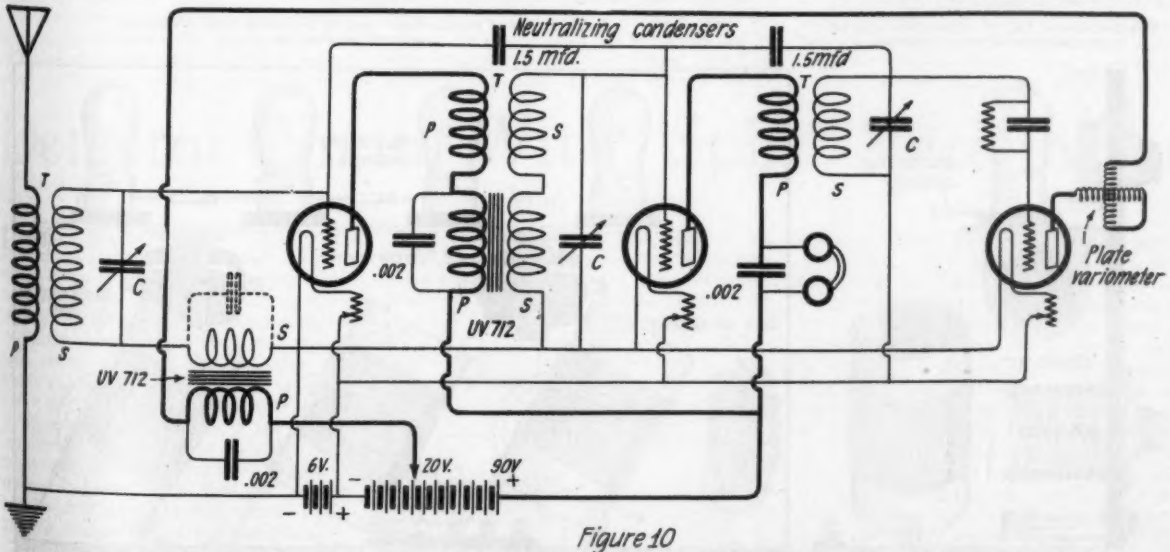


Figure 10

Reflex neutrodyne receiver containing two stages r. f. amplification, regenerative detector and two reflex audio stages

5-Tube Neutrodyne Amplifier

The circuit of figure 9 is a 5-tube amplifier containing two stages of tuned radio frequency amplification, a regenerative detector and two stages of audio frequency amplification. The transformers T are those shown in figure 13, and the neutralizing condensers (figure 12) are of the construction already described—capacitive coupling being neutralized by connecting these condensers between grids as shown.

cuit of figure 9 except that the first two tubes serve both as audio and radio frequency amplifiers. The incoming signal from the antenna is amplified at radio frequencies by the first and second tubes in the usual manner and then applied to the detector tube, which may or may not be regenerative. If standard regeneration is not desired, the plate variometer is either short circuited, set at minimum, or removed altogether. The radio frequency is rectified into audio frequency and applied to the grid of the first tube by means of a UV-712 amplifying transformer. The audio frequency is further amplified by the second tube, the phones or loud speaker being connected in the plate circuit. Audio and radio frequency windings are in series and it is necessary to have by-pass condensers of .002 microfarad capacity connected across the primaries of the audio frequency transformers and across the telephones, so that the radio frequency currents will not be obstructed. The secondary windings of the UV-712 transformers have sufficient distributed capacity for this purpose and no additional condensers are necessary. The radio frequency windings offer practically no opposition to the passage of the audio fre-

The Wireless Age (January 1923) and there is therefore no need of going into more elaborate discussion.

Figure 10 illustrates essentially the cir-

quency currents. Amplifier tubes are used throughout. The plate voltage is furnished by four B batteries having 90 volts.

frequency which is rectified into audio frequency in the detector. Neutralizing condensers are connected between grids of

audio frequency is applied to the grid of the first tube through a UV-712 transformer, is then amplified in the plate circuit, and

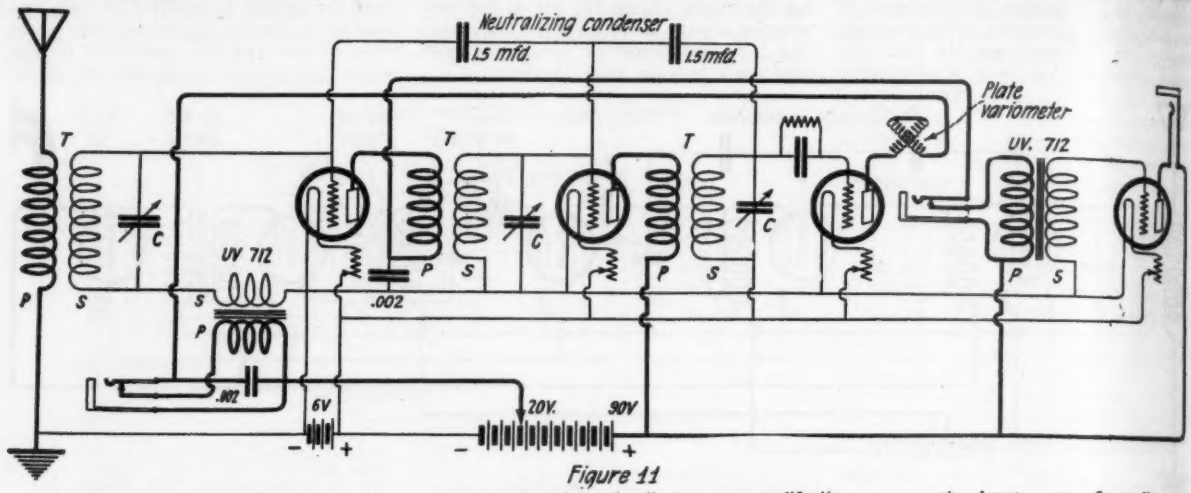


Figure 11

Best type of reflex neutrodyne receiver. It contains two steps of tuned radio frequency amplification, a regenerative detector, one reflex audio stage and one external audio stage of amplification

A reflex amplifier in which both stages of audio frequency are reflex is rather difficult to handle and generally quite noisy, so that the writer would not recommend it except to amateurs who are interested in tackling knotty circuits.

4-Tube Reflex Neutrodyne Amplifier

The best combination of reflex and neutrodyne amplifier is shown in figure 11. The first two tubes amplify at radio

tubes in order to stabilize the radio frequency amplifier. From the plate circuit of the third tube, which is the detector,

applied to the grid of the fourth tube by means of a second audio frequency transformer.

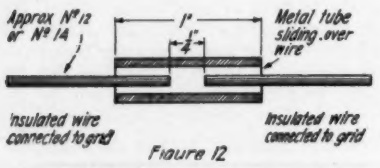


Figure 12

Construction of the 11 micromicrofarad adjustable neutralizing condenser

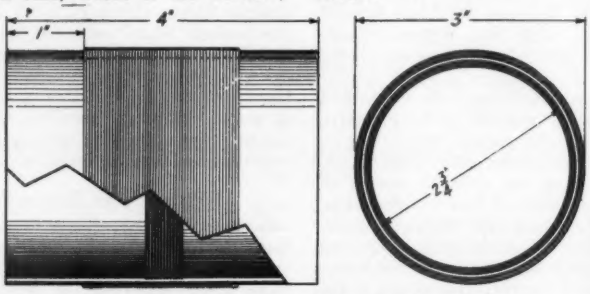


Figure 13

Construction of transformers used in the tuned radio frequency neutrodyne amplifier

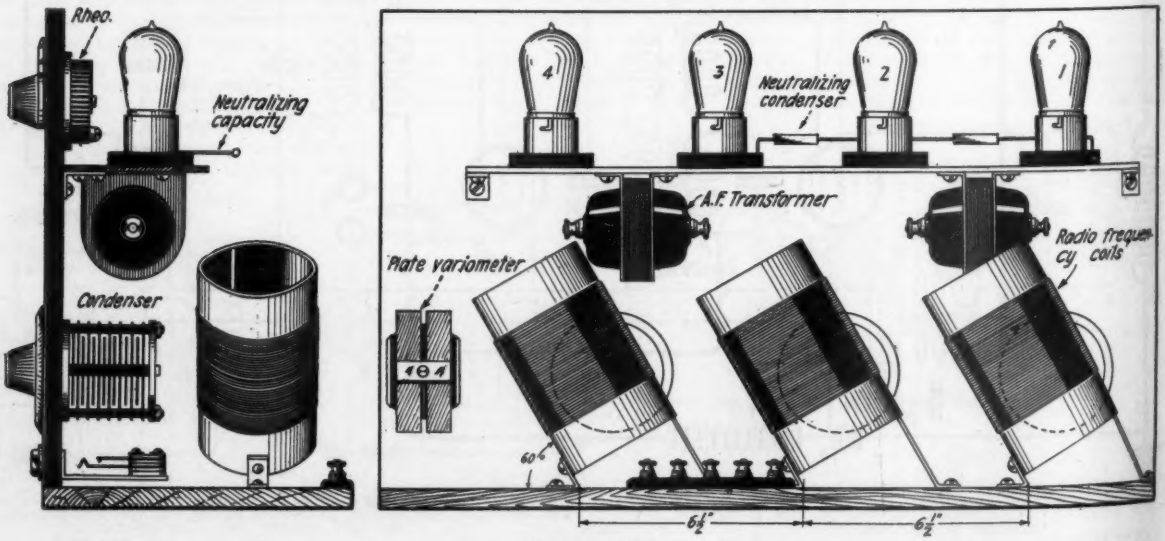


Figure 14

Arrangement of apparatus for the reflex Neutrodyne receiver shown in figure 11. Note position of radio frequency coils to prevent inductive coupling

Jacks are connected in the circuit, so that the listener may plug in on the detector or either of the audio frequency stages. This circuit is probably the best reflex neutrodyne, since no large audio frequency voltages are impressed on the radio frequency tubes.

The layout of apparatus for such a set is indicated in figure 14. The four-tube sockets are mounted on a long horizontal panel, on the under side of which are suspended the audio frequency transformers and the blocking condensers. The tube panel is supported by the vertical panel, which also contains the rheostats and tuning condensers, and also the variometer in the plate of the detector tube. The radio frequency coils, whose construction is shown in figure 13, are placed approximately six inches apart and inclined so as to make an angle of 60° to the base. This is done in order to avoid inductive coupling between stages. All binding posts are in the rear.

The neutralizing condensers are connected from grid to grid as shown in the diagram and their construction is illustrated in figure 12.

The operation of this set is the same as that described previously.

Radio Frequency With Regeneration

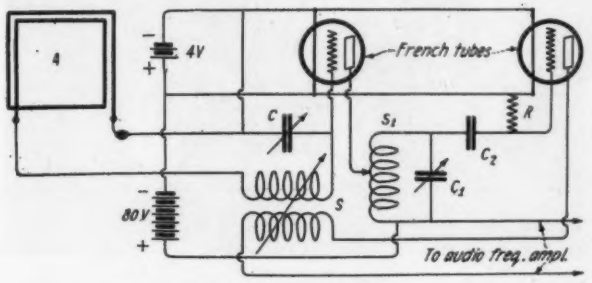
By J. Roussel

Translated from "La T.S.F. Moderne," Paris, December, 1922.

"CAN one receive American amateurs on a loop? This question has been asked by a certain number of persons who are unable to use the outdoor antenna, such as our Parisian friends, for the most part. The thing is certainly difficult, but we cannot consider it impossible, surely not without making an attempt. There is, moreover, an important precedent, namely, the reception at Paris on a loop, of English amateurs, carried out with regularity by one of the members of the French Radio Society, Monsieur Faucher.

"It is his hook-up, which he has been kind enough to furnish us for our readers, that we are going to explain. This hook-up, if it collects less radio energy, nevertheless has an advantage over the antenna, and a very appreciable one, of being much less susceptible to atmospheric perturbations of the type generally known as static. Moreover, it utilizes all the energy collected by the antenna system and by increasing the size of the loop, and using a greater number of radio frequency tubes, and raising to three the number of audio frequency amplifiers, one can obtain positive results. In principle, this hook-up consists of radio frequency with inductive coupling and regeneration, as well.

"Nevertheless it seems to us that it would be preferable to obtain the Armstrong effect by tuning the plate circuit of the second tube, this tuning being accomplished by means of a variometer. The remarkable results obtained by this system have been, among others, the following: Reception of (French) 2JZ and of (French) 2ON on November 4th at 8:30 p. m. Reception of (French) 8AB on the 5th of November at 8 p. m. The vacuum tubes used were the ordinary receiving tubes.



Monsieur Faucher's hook-up

"The accompanying diagram illustrates the hook-up utilized by Monsieur Faucher. The constants are as follows:

"(A) Loop formed of a single turn, 4 meters by 2½ meters (13.12 feet by 8.2 feet). This single turn is fixed against a wall extending north and south and insulated from the wall by porcelain knobs. The diagram shows two turns, but best results have been obtained with a single turn as indicated above. It will be remarked that such a loop cannot be oriented and that therefore it is not used in the best manner for directional effects.

"(S) Primary and feed-back coils: This consists of two coils whose coupling is varied by rotation on a common axis. The exterior one of these coils, which is in series with the loop antenna, consists of 16 turns of 2 mm. S.C.C. wire (about No. 32 U. S. gauge) wound on a tube 90 by 80 mm. (3.51 by 3.12 inches). The interior coil, which serves as feed-back for the detector tube, consists of 16 turns of the same wire on a form 80 by 70 mm. (3.12 inches by 2.73 inches).

"S-1 is the secondary tuning coil and can be constructed in two different ways. It may have 25 turns of .6 mm. D.C.C. wire (about No. 23 U. S. gauge) on a tube 45 mm. in diameter (1.755 inches); these turns to be slightly spaced, not more than 6 per centimeter or about 15 to the inch; or it may be of 38 turns tightly wound on a tube 60 mm. in diameter (2.34 inches).

"(C) A condenser for tuning the loop antenna, .0001 mfd.

"(C-1) Secondary tuning condenser, .0001 mfd.

"(C-2) and (R) are the conventional grid condenser and grid leak. The output from this hook-up goes to the conventional audio-frequency transformers. That part of the system contains no special features."

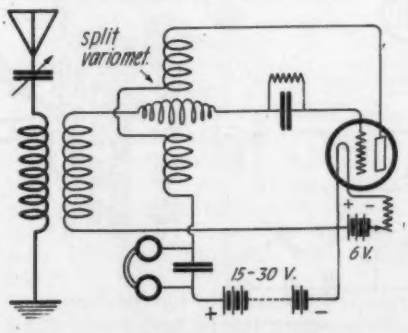
Detector Circuit With "Split" Variometer

By Wm. Hofmann

IN 1912 I had one of the three wireless telegraph stations here in town. Tuning was unknown to us then and we used liquid rectifiers for detectors and spark coils for sending. Reception was good among us, but no outside waves ever vibrated our phones. Soon storms took toll on the other two aerials and as mine then seemed useless, I took it down. After that I lost track of all the advances in wireless until a few months ago when I was attracted to radio by a friend then building his first set. So you see I am a newcomer in the field and perhaps what I wish to say is old stuff, though I have not seen it described in any periodical.

After considerable experimenting I have found that a variometer makes a very excellent regenerator if the stator terminals are disconnected from the rotor. This is chiefly of interest to those who have only a limited supply of battery current and are limited to one tube.

The results are nearly equivalent to the ordinary two variometer variocoupler sets using two stages of audio amplification in loudness, and slightly clearer because the noises of the B batteries of the amplifiers are absent. The detector requires a little more filament current with this hook-up than in an ordinary circuit and the loudness is increased in proportion to the increase of filament current, also the B battery must be increased in proportion to the A battery. Maximum loudness is obtained when using twenty-seven volts though it will detect at fifteen. The plate circuit requires the most wire so the stator is connected into the plate circuit and the rotor into the grid circuit. My aerial is only one hundred feet long including lead-in and a loose coupler is the only coil I got any results with. The coupler is wound with No. 24 wire and the variometer with No. 22. Tuning is done mainly by sliding the secondary coil after the right setting is found for the rotor. However, if the B battery voltage is changed the rotor must also be moved a little.



Single tube circuit with a "split" variometer for regeneration

DX Transmission From a New York Apartment

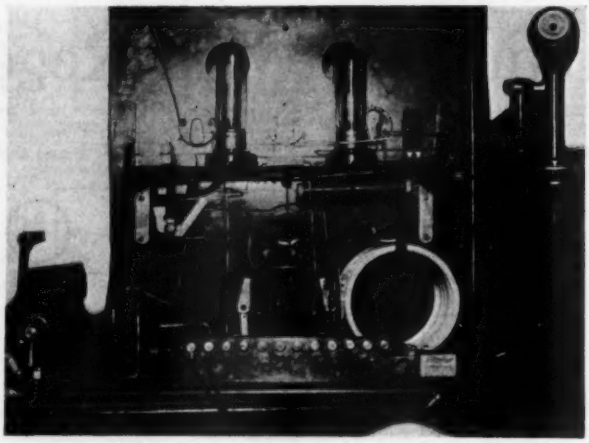
By R. L. Duncan

DR. B. W. KIRSCHNER, residing on the tenth floor of the twelve-story Manchester Apartments, at 225 West 108th Street, New York City, operates 2CNK, the 100-watt C.W. and I.C.W. station described in this article. He has received reports on his signals from practically all over the United States and Canada. 6XAS, 8BOZ, 9PW, 4BX, 3BLU, 1XU, 9AOT, 8BEO, 3CC, 8BMK, 1CMK, 9BIK, and 8KG are a few of the stations who have reported him QSA without using radio frequency amplification.

The transmitter follows the "Hartley Circuit" with the following modifications: Grid chopper is in the ground circuit, insulated to the shaft of the motor by a bakelite bushing. Plate circuit reactors are placed in each of the high potential lines as choke coils.

Radio Corporation of America parts are used throughout with the exception of the Esco motor-generator and Weston meters. The plate supply is a maximum 1200 volts D.C., 12 volts D.C. maximum for the filament.

The antenna is a four-wire cage of seven stranded No. 18 phosphor bronze on ordinary bicycle hoops, L shape, 66 feet long. The lead-in is also of cage type 5 inches in diameter, composed of four wires 35 feet long. The antenna runs from the roof of Dr. Kirschner's apartment to a large water tank on the top of a ten-story adjoining apartment. Spread out from his windows to the roof of the adjoining apartment in fan shape, are eleven wires, forming the counterpoise. The center wire of the counterpoise is approximately 50 feet long, the others longer in proportion to the distance separating them, which distance is approximately two feet at the outward end. The distance separating the counterpoise from the antenna is 30 feet. All steel and copper edgings and copings on the roof of Dr. Kirschner's apartment, as well as those on the adjoining roof are connected to form a separately tuned ground to the transmitter. The ground therefore consists of counterpoise described above with the tuned ground; approximately 75 per cent. of ground current flowing in the counterpoise and 25 per cent. in the ground. The reader is referred to page 71 of the January, 1923, WIRELESS AGE for antenna construction in detail.



100-watt C. W. and I. C. W. transmitter at 2CNK, owned and operated by Dr. B. W. Kirschner, of New York City

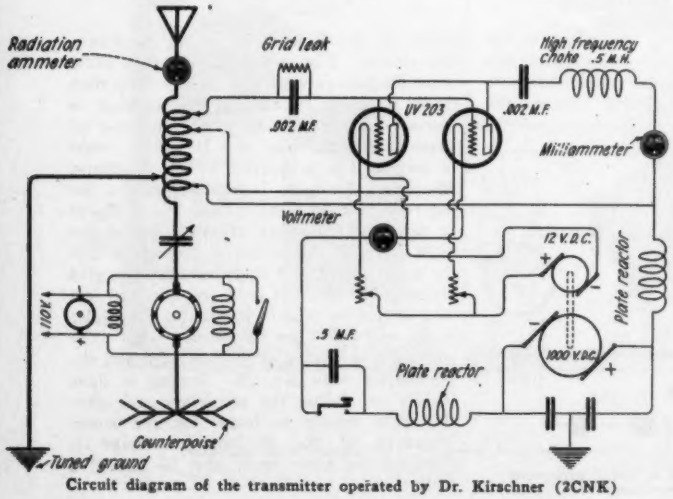
The antenna current is 5 amperes with a space current of 300 milliamperes using 1200 volts on the plate and 10 volts on the filament. With a space current of 200 milliamperes, 1000 volts on the plate and 10 volts on the filament the antenna current is 4.2 amperes. The antenna resistance is about nine ohms. The transmitter is wired with No. 10 soft drawn copper wire.

Since the grid chopper normally would emit a very sharp wave, seven turns of ordinary antenna wire has been wound on a small bakelite tubing and placed around the chopper which gives a variation of about two meters in the emitted wave.

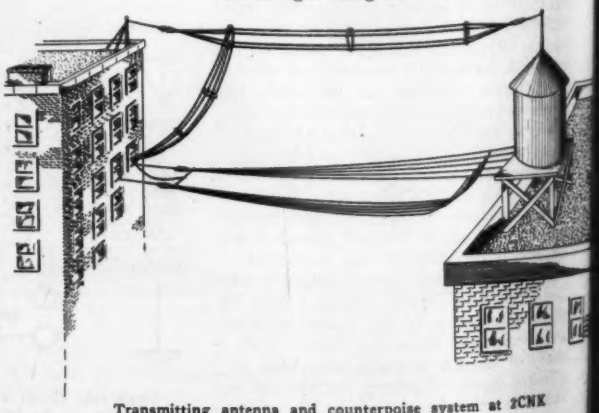
The receiving set is the ordinary regenerative circuit, employing variocoupler with double tapped primary, secondary condenser and plate variometer with detector and two stages of audio frequency amplification shielded entirely. Reception is accomplished by a one-hundred-foot single wire aerial on the roof.

All city apartment house dwellers are not permitted to put up aerials even for reception only. Yet upon most roofs that accommodate the one or two-wire receiving aerial, space can generally be found for the transmitting antenna and counterpoise. It is true, theoretically, that New York City, on account of its large steel buildings absorbs a large amount of transmitted signal strength and therefore, Dr. Kirschner had to overcome this very serious obstacle to low-power transmission before he could be heard from coast to coast. Differing from the old "rock crusher" spark transmitter, it takes many weeks of experimenting with C.W.—trying this and that arrangement until the long looked for results are accomplished.

Dr. Kirschner has been interested in experimental radio for several years but it has been only within the past year that his thoughts have turned to the amateur transmission field. It is now no uncommon occurrence to hear 2CNK in the wee small hours of the morning pounding out DX, or saying "GA OM I'll QSR." He has taken the complete tube course offered by the Radio Institute of America and now he works right along with the old timers.



Circuit diagram of the transmitter operated by Dr. Kirschner (2CNK)

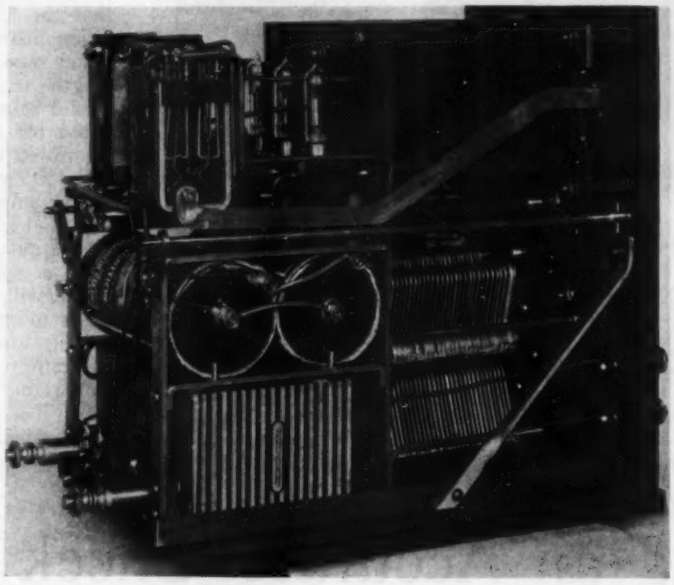


Transmitting antenna and counterpoise system at 2CNK

For Instant Tuning on Board Ship

New Uni-Control Receiver Covers 250 to 3,500 Meters With a Single Knob— Embodies New Invention in Variable Couplers and Inductances — Exceedingly Compact

DIFFICULTIES experienced by commercial operators on board ship in tuning quickly to various wave lengths have led to the development of a new tuner in the Research Laboratories of the Radio Corporation of America. The new tuner, which has but a single control knob, embodies the invention of Dr. Alfred N. Goldsmith, Director of the Research Department and Mr. L. Shapiro of the Research Department. As yet it has not been placed on the market, pending issuance of certain patents covering inventions embodied in it. As a matter of fact the present depression in shipping is so severe as to limit purchase of new equipment by ship owners, however desirable that equipment may be, so that it is doubtful if many buyers would present themselves should this new tuner be offered now.



The uni-control receiver completely assembled

Speed in tuning has been sought ever since radio traffic between ships and the shores grew to appreciable proportions. Now that radio equipment is compulsory on practically all ships, and the facilities offered by wireless are in continual use for private, public and navigating purposes, the other has become burdened with signals, resulting in use of many other wave lengths than that of 600 meters commonly assigned to ships.

As is well known, it is now common practice to use 600 meters primarily for calling, shifting to some other length as soon as the called station responds. This custom was mainly responsible for the development of the "stand-by" tuner, which can be set at that or any other wave and is customarily left unchanged, other wave lengths being picked up by means of the ordinary commercial tuner. By throwing a switch the stand-by is connected in and out of the detector circuit. Thus is afforded instant tuning at any moment to any predetermined wave.

The ideal tuner for ship use, therefore, would be one in which any wave length could be selected by a turn of the wrist. As anyone knows who has seen any of the present commercial receivers, simplicity of control is precisely what they haven't got, some eight or nine or more adjustments being provided. While these very properly place before the operator the possibility of extra fine results by giving every part of every circuit an individual adjustment, still considerable time is required to secure the utmost of which the receiver is capable. Under the frequently high pressure of these days of large traffic volume, the operator finds himself snatching at the most convenient adjustment that will bring in the desired signal somehow, relying upon his ears to read through interference, rather than upon the receiver to tune it out.

Aware of this condition, Dr. Goldsmith considered the possibility of making one knob adjust all the circuits simultaneously. The fact that each tuning element bears a definite relation to all the others seemed to him to present interesting possibilities especially in view of the fact that mathematical ratios can be expressed mechanically by means of gears, cams and levers.

In working out his ideas Dr. Goldsmith has evolved an instrument much simpler in construction than might have been expected, and also much more compact. The major part in condensing the units to small size, and in unifying the control was played by an invention of Dr. Goldsmith in the art of varying inductance and couping. He discovered that an inductance wound in the form of a flat coil may be varied progressively by moving a metal plate parallel and close to it. Tests showed an astonishingly great range of variation, with a correspondingly wide range of wave lengths covered. In addition, the flat coil and metal plate occupied a minimum of space.

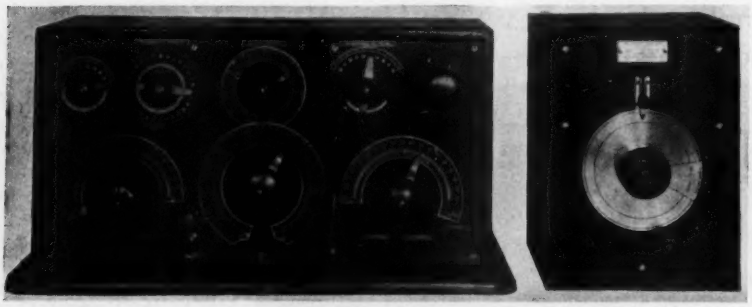
Similarly, it was found that the inductive coupling between two parallel flat coils can be varied within wide limits by sliding a metal plate between them.

Here, then, were the elements necessary for the single control receiver: tuning coils that, while compact, afforded resonance at longer waves up to 3,500 meters, and direct means of tuning down to 250 meters or less without using taps, shunts or in fact any of the more usual space-occupying and time-consuming controls.

These elements are found in the Uni-Control Receiver, as it is called, consist of the necessary flat wound inductances, held between thin fibre sheets, and metal plates of thin gauge, held on a shaft, which swing through the proper spaces between the sheets. The shaft holding the plates or shields is connected to the single control knob, as is also the rotating member of the conventional variable condenser that is placed in the antenna circuit. By the use of gears between the knob shaft and the condenser and shield members, the proper relations are maintained at all times between capacity, coupling and inductance. A single switch is provided for changing from long to short waves and vice versa. Externally the receiver consists of a simple box, about 10 x 12 x 18 inches, with a panel bearing a single dial and knob, a fine adjustment, a switch, and a pair of binding posts. The dial is graduated

in wave lengths and has two scales. A pointer connected with the switch indicates the one that is in circuit.

The receiver must be a precision instrument in every particular, as may be realized from the necessity for mathematical exactitude in order to keep the electrical relations of the different tuning elements at the desired values at every point on the scale. The experimental models that have been constructed show fine workmanship. One of them contains not only the tuner, but also a detector and two-stage amplifier, with A and B batteries, complete, the tubes using dry cells for both filament and plate. This naturally is about a third larger than the tuner alone—and still is only about a third the size of the ordinary commercial receiver!



The uni-control receiver (right) compared in size and number of controls to the ordinary marine commercial receiver, at left

The first public intimation that such a convenient receiver had been invented was through the daily newspapers, an enterprising photographer having snapped the receiver. Prints were distributed through a news syndicate. Publication of the picture a few weeks ago with a simple caption stating that this was a receiver with but a single control brought inquiries to THE WIRELESS AGE from many parts of the country, mostly from broadcast listeners. To these the regretful answer is that the Uni-Control tuner is a precision instrument, built like a chronometer one might say, covers wave lengths from 250 to 3,500 meters, and would be a uselessly extravagant purchase for a broadcast listener who is interested only in waves between 300 and 400 meters.

For ship owners, ship radio operators, and commercial stations generally, where quick selection of wave lengths over a wide band is necessary, the tuner will be a great help, enabling them to cut down the time taken in tuning, and permitting a greater flow of traffic. At present, the tuner is an important engineering achievement; when it is placed on the market it will be a valuable asset to the commercial radio world.

Keeping an Accurate Check on the A Battery

By Dr. Arthur R. Garvey

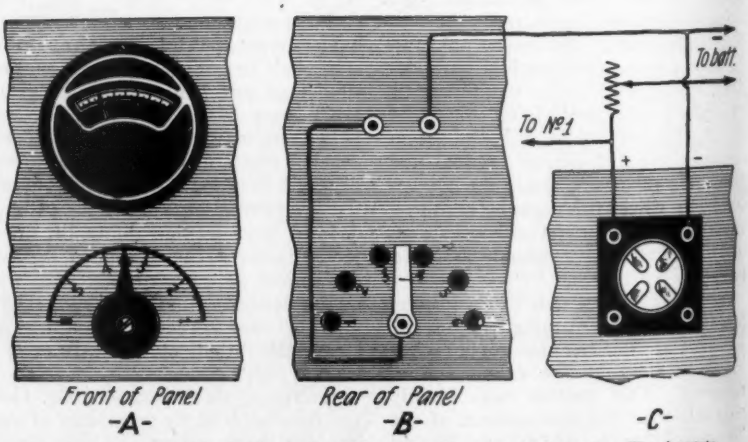
EVERY radio set should have a voltmeter to accurately check the amount of A battery voltage on each tube and also for the purpose of determining the condition of the battery at any time without the least bother. The greatest hindrance to the amateur being so equipped is that he cannot afford voltmeters for each tube, nor does he want to sacrifice the space on the panel for so many meters.

I am using one meter for all tubes and also to test my storage battery. All these tests may be made with a slight turn of the wrist at any time. The wiring is simple and can be neatly made.

Mount the voltmeter in the desired place on the panel and directly underneath it, any of the many type of inductance switches on the market, first cutting off one of the blades on the back of the switch, making it an ordinary single pole switch. Solder wire to switch arm and lead same through voltmeter and then directly to the negative side of the storage battery connection. Solder wires onto each switch point as directed in diagram and lead to points designated. Points one to four inclusive should go directly to the positive terminal of the tubes indicated. Make sure before doing this, however, that the rheostat is on the positive side of the battery, or, if your hook-up works the other way, reverse the directions just given. All that is necessary is to have the rheostats all on either the positive or negative side of the battery. One terminal of the voltmeter goes directly to the side opposite from that which the rheostats are on and the other voltmeter terminal goes to the terminal on the bulb socket which leads to the rheostat. Switch point number five goes to the positive side of the battery direct. It can readily be seen that a direct reading of the battery is always available. This is particularly handy when trouble develops out of a clear sky, for if the trouble is a dead storage battery, it will immediately be indicated by the voltmeter.

Terminal number six has no battery or tube connection, and it can be seen that there will be no reading on the voltmeter as it will be out of circuit. There is practically no consumption of "juice" by a voltmeter, however, and I always make a practice of leaving it on number five as a register of my battery condition.

Many to whom I have suggested this plan have adopted it, and are delighted with the results obtained, so I feel that there are others who would like to hear about it.



Figures on panel indicate positive leads which go directly to terminal on tube. The rheostats should be on that side of the line. (1) Detector tube; (2) 1st stage; (3) 2nd stage; (4) 3rd stage; (5) positive side of "A" battery for testing battery alone; (6) no contact—voltmeter not in circuit

(A) Front of panel showing inductance switch and voltmeter; (B) rear of panel showing inductance switch and voltmeter terminals; (C) view of detector tube connections to voltmeter

English Report on the Trans-Atlantics

FINAL reports on the reception of American amateur stations during the Trans-Atlantic tests last December show that 29 per cent. or nearly one-third of the total number of stations that qualified in the preliminaries were received in England during the finals, the falling off in the number from the more distant stations accounting for the drop as compared with those near the Atlantic coast. The 66.6 per cent. from the first district is particularly noteworthy.

The most successful districts were in order the First, Second, Third and Eighth. This, of course, was to be expected, both from last year's tests and also because these districts are near to the Atlantic seacoast. The Sixth and Seventh districts, on the Pacific coast, are naturally less well represented. A Sixth district station was, however, heard with code word, thus verifying the reception, which reception is really a remarkable performance considering that the station is located in Arizona, on the Pacific side of the Rocky Mountains. Signals from all districts have been reported, but as several of these from the Sixth and Seventh districts were only ordinary DX calls, it was not possible definitely to verify them, as in the case of the individual transmissions.

The number reported varied largely from night to night, there being in particular two bad nights and one especially good one, and bearing this in mind, an average of over 200 interceptions from 50 different stations per night seems to the writer to be a great tribute both to the design of the receiving apparatus used, and to the skill of the operators who were listening in.

During the ten days of the reception tests reports were received from 47 different amateur listening stations in Great Britain, and from two Dutch stations, making 49 in all. The total number of interceptions of United States and Canadian amateur signals reported in this way during these ten days were 2,297. This figure includes all interceptions — "Individual" transmissions; "Test" signals during the free-for-all periods; and calls and messages from stations simply carrying on their ordinary communications and "DX" transmissions.

Some of the stations heard signalled to the effect that they would try radiotelephone transmission. In most of these tests it was reported that their carrier wave could be heard quite strongly, but that the percentage of modulation was too small to enable the voice to be heard when the local heterodyne was switched off. In a few instances, however, reports were made to the effect that the phone transmissions were heard. The stations thus reported were: 2EL, 2XAP, 2ZK.

On the best nights of the tests, the ether was so full of signals that it was not possible to log more than a small proportion of the total for the above reasons. In addition to the above-mentioned difficulty most listeners in this country were hampered to a greater or lesser extent, depending upon their locality, by harmonics from various high-power stations. Of these, of course, the most complained of from all parts were Leafield and Northolt, with their multitudes of harmonics and "hash" bands in the short wave regions. Stonehaven was also troublesome to some, as were also the very bad spark harmonics from FFU (Ouessant, France), and from the short wave spark transmissions. On one occasion "SOS" calls from Niton and FFU on spark jammed out American signals for some time. Many listeners in the neighborhood of London, in particular, found it quite impossible to receive anything on wavelengths near 200 meters until after Northolt had finished its press transmission—usually about 3 a. m.

The marked difference between the number of nights on which some stations were heard as compared with others was very interesting. The signals from the best stations were capable of being heard under almost any of the conditions met with during the period of the tests, and any improvement in the transmission quality was merely noted in the increased strength of the signals received from these stations. On the best nights and times the signals from the best stations were of extraordinary strength, 8AQO in particular being reported by most listeners as being of exceptional strength and readable many feet from the telephone receivers. The nights on which his individual transmissions were not heard his transmission times were earlier than 3 a. m., and therefore came in a very bad period, since during the worst nights of the tests signals were only reported during the last two hours or so before 6 a. m.

Following are the names and addresses of the British and Dutch amateurs who reported reception of 25 or more stations during the tests:

British and Dutch amateurs who reported the "Individual" Transmissions.

J. Briggs, Brank House, Ainsdale, Southport, 65.

Manchester, Wireless Society (Receptions by W. R. Burne & A. Cash), 43.

B. H. C. Matthews, Hillcroft, Nore Road, Portishead, near Bristol, Somerset, 38.

W. E. F. Corsham, 104, Harlesden Gardens, Willesden, London, N. W. 10, 34.

D. W. Walters 4, Mansel Street, Gowerton, Swansea, 31.

G. J. Eschauzier, 19, Parkweg, The Hague, Holland, 29.

E. W. Penney, 34 Coldsenick Street, St. Budeaux, Plymouth, Devon, 27.

A recent issue of *The Wireless World* of London, contains the following summary of the reported reception of European amateur stations by American listeners during the recent trans-Atlantic tests:

English:

5WS—Reported	by	10	American	listeners.	
2FZ —	"	"	9	"	"
5SW—	"	"	1	"	"
2PO —	"	"	1	"	"
2JZ —	"	"	1	"	"
French:					
8AB —	"	"	2	"	"

Since receiving the American report inquiries have been made in order to ascertain, if possible, whether the reported reception of 2FZ could possibly have been receptions of some other British station having a call sign which might be misread as 2FZ, such for instance as 2FQ or 2FP, both of which stations were transmitting during the tests. The time of these reported receptions, however, does not fit in at all with the time of any transmissions made from England, and it can therefore only be concluded that some confusion has arisen in these reported receptions of 2FZ. Possibly the signals that have been reported in this manner may have really had their origin at an American transmitting station, or else a transmitter has been employing an incorrect call sign.

The reported reception of 2JZ is also apparently in error, since 2JZ was unable to operate his station during every night of the tests and did not transmit any signals at all on the date reported.

No British station having the call letters 2PO was taking part in any of the individual transmissions in England, and no station having these call letters can be traced in any of the published lists of British amateur transmitting stations.

It therefore appears that the only British station unquestionably heard in America with verified code words and other transmission was the special station of the Radio Society of Great Britain, 5WS, which was erected at Wandsworth for the tests, and that the only French station heard was 8AB, which is operated by M. Deloy, at Nice, France.

It is also of interest to know that two other reports have been received of the reception of the test signals sent from England and France, one report emanating from the operator of a vessel bound from New York to Europe, and the other from the operator of a station at Reykjavik, Iceland. These reports are as follows:

The ship operator was listening in on a receiver using a single detecting valve, the fundamental wavelength of the relatively large ship aerial being reduced by means of a series condenser. Signals from 5WS were first heard on the morning of December 24th, when the vessel was 900 miles east of New York, and therefore approximately 2,500 miles west of London, taking a Great Circle measurement.

On Christmas morning, at about 2,200 miles from London, 8AB, a French station, was heard, and signals from a British amateur station were intercepted, sending Christmas greetings, the call letters of this station being doubtful, but thought to be 2SH.

On the morning of the 26th, signals were again heard, including the code word MUPZN, which was allocated to British 2OM located at Brentford, Middlesex. At this time the vessel was approximately 1,900 miles from London. On the morning of December 27th, when the vessel was another 200 miles nearer England, signals from 5WS and 2SH were again copied. On the morning of December 28, 5WS was heard again by the vessel, which was then another 200 miles nearer England. On December 30th, when still some 1,100 or 1,200 miles away, signals from the following British stations were heard:

2AW—Wakefield, Yorkshire.
2OM—Brentford, Middlesex.
2SH—Highgate, London.
5MS—Manchester Wireless Society.
5WS—Radio Society of Great Britain.

A French station, 8RRX, was also heard.

The operator at Reykjavik, Iceland, who was only able to listen-in on one or two nights, as the set was borrowed, reported that, using a single valve only, the signals from 5WS, including the code word, were heard on December 24th, while later on the same morning the code word of 2AW was heard also.

Commenting on the result of the westward tests, *The Wireless World* says: "Doubtless the American listeners had many sources of interference, as had also the British amateurs listening for their signals in the first part of the tests, and as several stations in this country had been granted special permission by the Post Office to use a transmitting power comparable with that employed by the American amateurs, the difference in the receptions in the two countries would seem probably to be due to the much greater use of radio-frequency amplification on this side. The general use of low-power transmitting stations in this country has doubtless been the cause of the development of the most sensitive type of receiver equipment suitable for the reception and amplification of short wavelength signals."

French Report on the Trans-Atlantics

By Dr. Pierre Corret

President Comité Français des Essais Trans-Atlantiques.

ALTHOUGH not one American amateur transmitter had been able to make itself heard with certainty in Europe during the course of the first trans-Atlantic tests, in February, 1921, and although only about 30 had been so heard during the second tests in December of that same year, the total number of American amateurs who were received, with or without code words, by twenty-six French amateurs and the two Swiss listeners during the course of the third series of tests in December, 1922, totaled 246, of whom only two employed damped waves, 1BCF and 2RP.

The scientific interest in these results is undisputable, especially if one considers that the greater part of the American transmitters have utilized a power well under the permissible maximum of one kilowatt and that the reception in Europe was often effected with a single tube or with a very small antenna. American station 8AQO, notably, which was received by a great number of European amateurs, has been reported by one of them as "excellent on a single tube," and "heard with head set on the table throughout the room, with superheterodyning easily readable at 10 meters (33 feet) from the head set, and fairly easily at 20 meters (66 feet) almost with the regularity of the great trans-Atlantic stations and often much louder than those, with an equal number of tubes."

The question of daylight transmission was not considered in these tests by reason of the great diminution in range during the day, which for a long time has been recognized as an obstacle to short waves. On the contrary, those hours were chosen during which it is night over the entire territory of Europe and America covered by the tests.

But even under these conditions great irregularities have been noted in the intensity of reception of any single transmitter. This intensity or volume can vary very rapidly from "excellent" to "unreadable," and return to "very good" an instant later. From these tests it seems to be possible to attribute the cause of these rapid variations in the intensity of reception of short wave lengths to absorption and perhaps even to reflections of the wave by atmospheric conditions.

Another cause of this absorption of short waves seems to have been made evident by the results of the trans-Atlantic tests. The stations transmitting with code word were found to be quite comparable one to the other, since on one hand they had to achieve a range of 1920 kilometers and since on the other hand they could not use more than the maximum power permitted of 1 kilowatt.

In the important experiments which have just been made with these short waves, whose use is now permitted in France, what are the methods of reception by which the best results have been obtained? By classifying these methods in perhaps an arbitrary manner, but in a way that general practice justifies, one obtains the following results:

Method of Reception	No. of Stations	Stations Received
Super-heterodyne	2	158
One stage tuned R. F.	7	153
No R. F.	8	102
R. F. by means of radio frequency transformers	4	59
Several stages tuned R. F.	3	9

The methods which gave the best results during the course of these tests were those known as super-heterodyning, the credit for the first idea of which belongs to a Frenchman, Mr. Levy, while the famous Mr. Armstrong has applied it to reception on short wave lengths. The other method that gave only slightly less favorable results, consisted of the employment of a stage of tuned radio frequency ahead of the detector.

Many of the operators who took part in the trans-Atlantic tests were led to cut down more and more on their audio-frequency amplification and even to do without it entirely, in order to avoid deafening their ears by the amplification of static.

French radio amateurs enlisted for the westward transmitting tests, of whom only ten actually transmitted, and only one, located at Nice, has been heard in America. Several of the stations that transmitted, did so only irregularly, on account of various difficulties and diverse incidents. Certainly but little time was given to transmitting each night and some worked only during one or two evenings.

The greater part of these stations, moreover, were not authorized to transmit with a power input greater than 100 watts. Several had, it is true, been authorized to use one kilowatt, but that permission was accorded only for the duration of the trans-Atlantic tests, and the small number of amateurs who could have undertaken the expense of installing a transmitter of that power did not feel justified in doing so for such a short time.

The only French station which was heard in America had been authorized, without time limit, to utilize a power of one kilowatt in continuous waves. This station put that power on the air by means of four tubes rated at 250 watts, connected in parallel, in the conventional manner, the grid coil being coupled to the plate coil forming a part of the antenna to ground circuit. A.C. in 25 cycles and in several thousands of volts pressure was applied directly to the plates.

Under these conditions 4.8 amperes was put into the antenna on 195 meters.

Reception of this transmitter in America was made rather difficult in the midst of static by the discontinuous character given to the emitted waves by the source of plate potential, which was alternating current at 25 cycles. In spite of that, this station was reported on December 23 and 25 by an American amateur using a detector and one stage of audio-frequency amplification. On December 30 it was heard with particular regularity and readability during an hour by another American who used a large untuned antenna with a detector tube in a regenerative circuit, followed by two stages of audio-frequency amplification. On December 26 and 28 it was heard by a radio operator on the French vessel *Janus*, which was at that time on the American coast at the mouth of the Delaware River. This also was with a detector in a regenerative circuit, followed by 2 stages of audio-frequency.

In consideration of the very encouraging results that were obtained, it is proposed to organize new tests on both telegraphy and telephony, on waves of 200 meters and below. Announcements of these will be made well in advance through the radio publications, but amateurs would do well to prepare for these now, for both transmission and reception.

How to Check a Hook-Up

By FRED JANTZEN

AFTER you have decided on the hookup you wish to use and have assembled the set ready for wiring, the following suggestion will, I am sure, help you in accomplishing a speedy and easy way to wire your set correctly the first time.

Cut out the diagram of your hookup and tack it on to a piece of cardboard just large enough to take the diagram; next take a piece of thin tracing paper, same size, and tack over diagram.

Decide next what wires should be put in first so as to avoid any acrobatic stunts of soldering other wires later on.

Now here is the stunt: Every time you attach a wire to your set trace it off the diagram in red ink or crayon being sure first before you do so that it represents the progress of your work. Repeat this process until the diagram has been completely traced.

If you do this right your hookup will be right the first time and the set will function properly provided the apparatus used is good.

EXPERIMENTERS' WORLD

Views of readers on subjects and specific problems they would like to have discussed in this department will be appreciated by the Editor

Importance of Lead-in Arrangements

By Samuel C. Miller

THERE has been quite a great deal written lately on ways and means of reducing the antenna resistance, but little material has been available on the importance of the antenna lead-in after it enters the lead-in insulator. A lot of care may be taken in the actual construction of the antenna and its down lead by keeping them away as far as possible from the building and surrounding metal conductors and by proper insulation; yet when the wire is brought from the lead-in insulator to the set it is just as important to take all the precautions that has been taken in putting up the antenna and down lead. In fact, the resistance of the antenna system may be sometimes increased 2 to 3 times due to lack of care in properly running the inside lead-in. This has actually been proven by experiment.

The antenna as indicated in figure 1, is 125 feet long, 40 feet high on one end and 25 feet high on the lead-in end. It is well insulated by electrose insulators and the down lead is kept away from the building about 1 foot for its entire length. It is brought into the building by means of a standard electrose lead-in insulator.

Two sets of measurements of the antenna characteristics were made by the method described by the writer in "Short Wave Reception Versus Antenna Resistance," October, 1922, issue of THE WIRELESS AGE. The first set of measurements was taken directly at the lead-in insulator and the other at a point 15 feet away. The resistance results obtained at various wave lengths directly at the lead-in insulator were quite normal, as shown by the curve A on the graph, but that obtained at the point 15 feet away gave an unusual increase in resistance, as indicated by curve B. It required no great deduction to determine that a short stretch of wire by itself inside a room could not give that uneven and large increase of resistance. So this phenomenon was investigated by eliminating various conductors in the immediate neighborhood of the lead-in. By this method it was found that this high increase of resistance was caused by a grounded conductor at right angles to the lead-in and crossing it at a distance of 6 inches. By disconnecting the ground from this conductor, or by taking it away entirely the antenna system was brought to a normal state. The result obtained is shown by curve C on the graph.

The importance of this experiment can not be over-emphasized. It is common practice for those who place their receiving set in a room other than that where the down lead is brought in, to run the inside lead-in around the moulding in a haphazard fashion. This may then cause the wire to run either parallel or very near the electric light conduits which are grounded, and the result will be a large increase of antenna resistance. Take, for example, the resistance at 360 meters, as indicated on a normal antenna by curve C and compare it to curve B at 360 meters. In the first case the resistance is 7 ohms and in the second 19 ohms or almost three times as much. This means that an antenna system with a characteristic of curve C will give a signal intensity of nine times that of one with a characteristic of B.

Another precaution that should be taken, is to keep the ground and antenna wires as far apart as possible. This will prevent any leakage of energy by capacity between wires before the signal is brought into the set.

Of course, the ideal method is to place the set directly at the lead-in insulator so that only a very short piece of wire is required between the two connecting points.

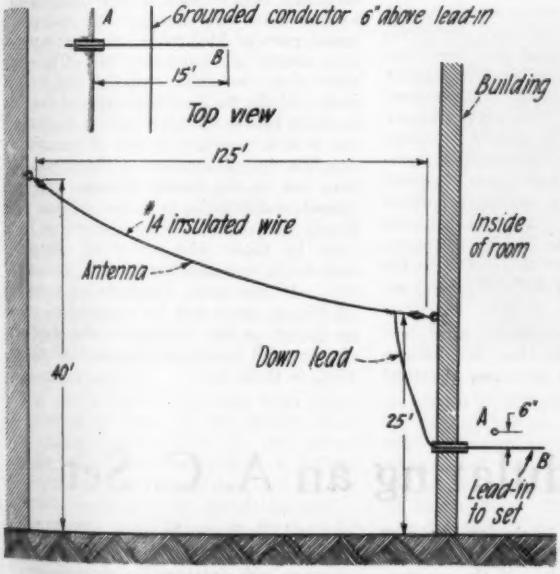


Figure 1

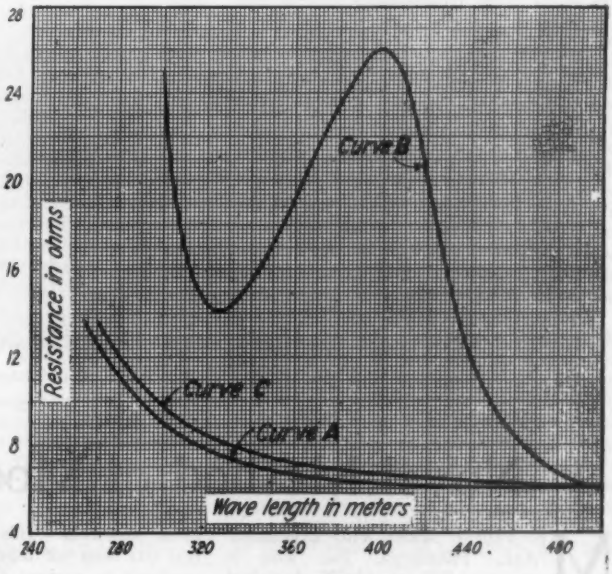


Figure 2

Figure 1—Constructional detail of antenna system and lead-in. Figure 2—Antenna constants. Curve A—With no grounded conductor near the lead-in, capacity = 0.00051 mfd.; natural wavelength = 205 meters; inductance = 23 microhenries. Curve B—With a grounded conductor near the lead-in, capacity = 0.00037 mfd.; natural wavelength = 180 meters; inductance = 24 microhenries

Production of WD-11 and WD-12 Dry Cell Tubes

ONE of the really dramatic episodes in the radio industry has been centering around the famous WD-11 tube, the receiving vacuum tube that operates on a filament terminal potential of 1.1 volts, which may be supplied by an ordinary dry battery of 1½ volts. This tube was by no means the first one designed for dry battery operation, one of its predecessors having been produced during the war for military purposes. The military tube, however, proved to be rather fragile and following the close of the hostilities considerable experimental work resulted in the development of the WD-11 tube as it is now known, one of great clarity in operation, exceedingly economical of current, and of excellent durability under both shipment and average use.

When development was at this point, production of the tube was put into what was at that time considered large volume. The executives of the Westinghouse Elec. & Mfg. Company and of the Radio Corporation of America possessed sufficient faith in the future of broadcasting, long before it had shown any unmistakable signs of its tremendous future, to go into the manufacture of the new tube in what then might have been considered by many as abnormal quantities. In fact, last Fall as a result of this production schedule there was in hand such a quantity of WD-11's that it was considered to be a five months' stock, judging by actual sales during the previous months, and allowing for a reasonable increase in the popularity of the tube.

However, what was the astonishment of the manufacturers and, in fact, all concerned with the manufacture and marketing of the tube, to find that this five months' stock was moved into the dealers' hands in sixty days and the dealers in turn disposed of them to the eager public almost as rapidly.

The result of this extraordinary demand was, of course, the subject of careful consideration, and called for an entire revision of production plans, in a most radical manner. Manufacturing had to be increased vertically upward and this was not an easy matter for such a highly specialized, intricate device as the WD-11. Great pressure was applied all along the line; pressure for volume and speed. In forty-five days production was increased to five times the previous figure. In fact, within six weeks the monthly output of WD-11's was at the rate of over 50 per cent. of the entire sales of that tube during 1922, exclusive of those tubes supplied as parts of complete sets. Thus, in January of this year, WD-11's were made in a number that greatly exceeded the total sales for 1922.

This is an accomplishment that is no less extraordinary than is dramatic the sudden flood of demands for the tube, and the gutting of the warehouses. Factory machinery and equipment had to be bought, installed and put into operation, hundreds of employees were trained to new work, raw materials were brought in under urgent orders and manufacturing rose to a height that even the most sanguine of the factory engineers had hardly thought would be possible in the short space of time in which it was accomplished.

In the meantime development work was being carried out on another dry battery tube which would have the same electrical characteristics as the WD-11, with certain mechanical advantages that would fit it for use in the standard Navy type bayonet sockets in which the 6-volt detector and amplifier tubes long have been used. The new tube has been named the WD-12, and became known to the general public only recently when the well-known RC and Radiola-5 sets were offered equipped with this bulb. It is suited to dry battery operation, taking a 1½-volt source for the filament, but unlike the WD-11, has the standard base of the same type and dimensions as the 6-volt tubes, and the glass has the same dimensions as the 6-volt tube.

Manufacturing of the WD-11 is being continued at its high point and it is expected that those desiring to purchase it will find it in increasing supply on the shelves of the dealers.

Production of the new tube, and the height to which WD-11 manufacture has been carried, indicate very strikingly the desire of a great part of the public for dry batteries as a source of filament current. The situation gives emphatic endorsement to the policy of the Radio Corporation of America to make broadcast receiving sets as economical in first cost and in cost of operation as possible, by elimination of the storage battery and of the battery charger, with their attendant difficulties as well as expense. The 6-volt tube will, of course, continue to be used by those who prefer its advantages and desire to obtain its valuable characteristics. It has made hundreds of thousands of friends who may be expected to adhere to it, just as the newcomers who start with the dry cell tubes may be expected to continue in their use.

Novel Method of Modulating an A. C. Set

MR. Paul J. Miller, 1133 Creedmoor Ave., Pittsburgh, Pa., who is operator GH at 8AGX, has had such a flood of inquiries following publication in these pages of his phone transmitter using A. C. for filament and plate that he asks publication of the constants of the set. His original hook-up with the values is given herewith. This is the arrangement that has been put together by a number of amateurs in various parts of the country, and produces a very rough voice modulation unless carefully tuned. When properly tuned the voice modulation and the carrier wave bearing the A. C. hum are sufficiently separated for a good receiver to pick up the one and eliminate the other. Since his success with this, Mr. Miller has made some changes with considerable improvement.

One of his first arrangements was to modulate by means of a loop of wire, from one to three turns, around the grid end of the inductance, with the microphone in series with the loop. This proved a considerable improvement, allowing better separation of the voice wave and the carrier. Those who have heard this on the air find it a satisfactory method, with very little of the A. C. growl present.

The next development from this set led Mr. Miller to self-rectified A. C. using two tubes and rectifying both sides of the cycle. Here again loop modulation is used in order to provide easy tuning for separation of the voice and the A. C. hum. The hook-up is shown in figure 2, in which the two inductances L1 are 250-turn honeycomb coils. Both these circuits can be used with a 5-watt tube, UV 202. For C. W. on either, the microphone is taken out of the circuit and a key inserted in series with the filament lead.

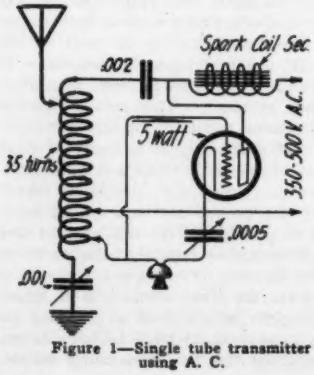


Figure 1—Single tube transmitter using A. C.

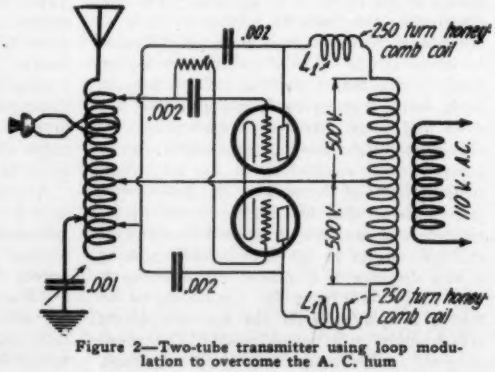
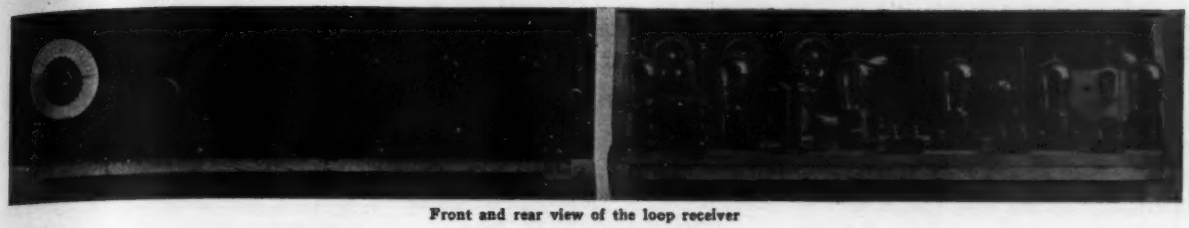


Figure 2—Two-tube transmitter using loop modulation to overcome the A. C. hum



Front and rear view of the loop receiver

That Loop Receiver

By L. W. Van Slyck

THERE are, in general, two types of loop receivers. There is the tuned radio frequency type, and the untuned type, the latter depending upon especially designed inter-stage radio-frequency transformers possessing a somewhat broad resonance curve, thereby suiting them for the reception of signals over a certain wavelength range with a not unreasonable efficiency.

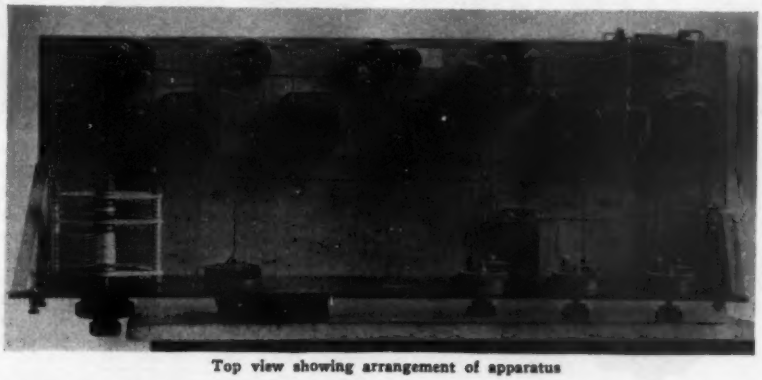
The tuned type of radio-frequency set, although approaching nearer to the ideal as far as selectivity and sensitiveness are concerned, possesses the inherent disadvantage of being exceptionally difficult to adjust when three stages are used, as compared with the untuned type. In view of the fact that there are radio-frequency transformers on the market today covering a wave band sufficient to include practically all broadcasting stations, and working at good efficiency over this band, it is believed by the writer that a practical receiver of this type would be very much in favor with the radio public as compared with the ordinary regenerative system due to its greater selectivity, freedom from distortion, and portability.

The cost is within reason (less than $55.00 without tubes and accessories) and the construction is simple if directions are followed closely. Lastly, tuning is not as difficult as with the ordinary two circuit regenerative receiver.

It is very essential that only high grade instruments be used in its construction. This applies particularly to the transformers and variable condenser. A vernier potentiometer is not necessary, but it aids materially in bringing in distant stations.

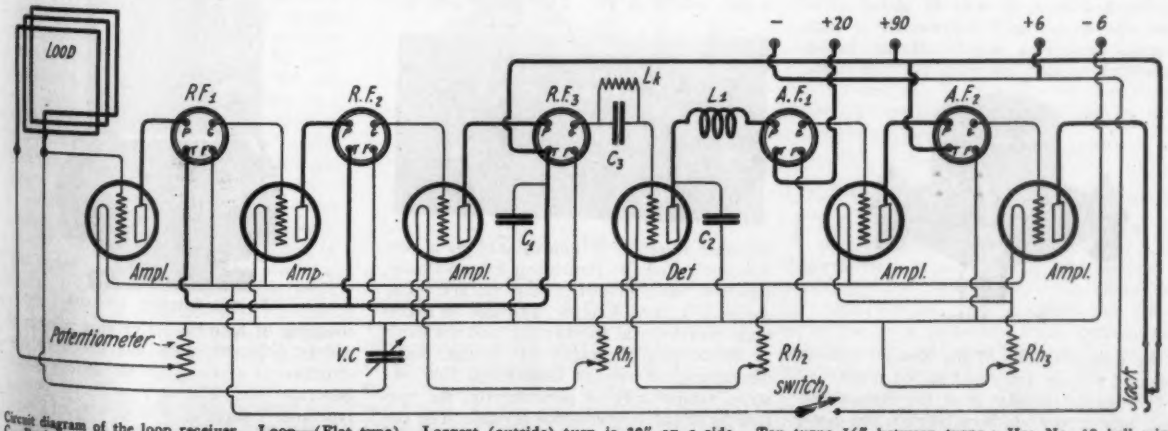
The bakelite panel should be about 36 by 6 by ¼ inches, and the base of soft wood, about 8 inches wide. Mount the transformers along the back of the base, spaced at equal intervals. Then about three inches, more or less, towards the front, and interspaced with the transformers, mount the sockets. These, by the way, are preferably of composition, with diagonally located contact springs in order to reduce parasitic capacity effects to a minimum. The mounting of the remainder of the apparatus is of lesser importance, except that it is well to attempt to follow as far as possible the physical layout of the apparatus in general as shown in the photographs, and to make all connections as short as possible. The high frequency wires should be isolated as shown, but the low frequency wires may be bunched. In fact, it is advantageous to bunch them. This is depicted clearly in the diagram.

If care is taken in the construction of this set, and if cheap apparatus is not used, no difficulty should be experienced in obtaining a consistent range of over one thousand miles on a two-foot loop. The set shown here can be depended upon most any evening to bring in KHJ (1800 miles) loud enough for phone reception, and to pick up Fort Worth (1000 miles) loud enough to operate the Magnavox. Havana, Cuba, comes in satisfactorily two or three evenings a week, and of course the nearer stations are always with us. It is possible to obtain satisfactory reception when some detector two-stage sets are mixed in a hopeless jangle.



Top view showing arrangement of apparatus

It will be a surprise to note the reduction of static and local noises, such as arc lights, sparking commutators, etc., with which all city dwellers have to contend to a greater or less extent. This set also possesses the distinct advantage of being non-reradiating, hence you need not worry of ever spoiling your neighbor's pleasure.



Circuit diagram of the loop receiver. Loop—(Flat type). Largest (outside) turn is 30" on a side. Ten turns ⅛" between turns. Use No. 18 bell wire. C_1—Ford coil condenser; C_2—'Phone condenser (Murdock); V. C.—.0005 mfd., 21-plate with vernier (pig tail connection is very desirable); Potentiometer—Standard vernier type (Central Radio Laboratories); $Rh_{1,2,3}$—Filament rheostats (Central Radio Laboratories); C_3—.00025 mfd. grid condenser (Remler); Lk—Variable grid leak (Central Radio Laboratories); R. F.$_{1,2,3}$—Mu-Rad T-11, 1-11A, T-11B, R. F. transformers; A. F.$_1$—Jefferson A. F. transformer (3:1 ratio); A. F.—Transformer A. F. (make unknown); Jack—(for 'phones or loud-speaker) single circuit type; L_1—Fifty turns No. 40 D. C. C. wire on a spool ¾" dia.; Sockets preferably of insulating material throughout, with diagonally mounted prongs

NEW APPLIANCES AND DEVICES

Mazda Radio Parts Show Careful Thought

THE Senior condenser, one of the Mazda parts, is a precision instrument carefully designed so that the first third of the dial covers a fifth of the total capacity range, the next third 60 per cent. of the total, and

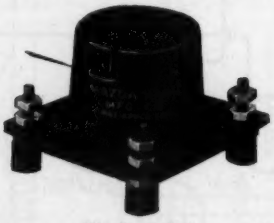
Mazda jack

the last third the remaining fifth. This means that for tuning-in the middle third is used, after which, by varying the inductance or coupling, it is possible to do much finer tuning at either end of the dial. This approximates a vernier effect. However, the condenser is provided with a vernier adjustment, a second knob connected by reducing gears having a ratio of 7 to 1. This

Mazda rheostat

also acts as a stop, the gears being cut only half-way around the rotor.

The condenser is made without spacing washers, the posts being seamless copper tubing in which slots are milled, thereby securing uniform spacing. The condenser may be had in 3, 23 and 43 plates. For those who do not wish instruments of such accuracy there is a line of Mazda Junior condensers, which, however, preserve some

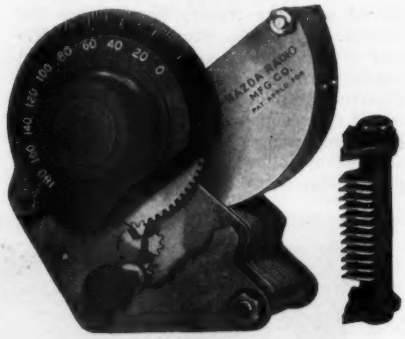


Mazda socket

of the unique details of the Senior, such as a geared vernier knob and milled posts.

The Mazda rheostat is of the carbon disc type, with copper washers between the discs, these being used as a result of tests showing that steadier adjustment was secured. The maximum pressure on the resistance unit is provided by a spring of the "rocking chair" type.

A special fusible washer is provided on the Mazda jacks on each connector post, with a screw. To make a soldered connection it is only necessary to insert the wire between screw and washer, tighten, apply a touch of soldering paste or flux, and heat with a match.



Mazda condenser

Mazda sockets are made in both metal and composition, and use not only bottom spring contacts for the legs of the tubes, but also side spring contacts, so that a good connection should be certain. The Mazda line also include plugs, dials and knobs, and an interesting "fixed" condenser of the tubular type, which may be varied within small limits by moving one tube within the other.

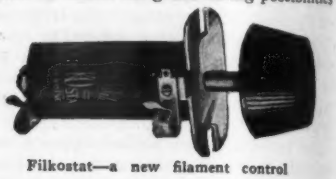
Hutchison Phono-Phane

THE marked advantages of the crystal detector are their lack of expense in operation, and the clarity of tone produced in radio telephone work. The marked disadvantage of the crystal is—or has been until recently—the delicacy of adjustment that is necessary in order to produce good results, or any results at all. This bothersome ad-

justment is rendered unnecessary by a new detector called the Hutchison Phono-Phane, which is being placed on the market. The device is a fixed detector, adjusted to maximum sensitivity at the factory, and not liable to disturbance thereafter by shocks, static discharges, or similar happenings that destroy, temporarily or permanently, the usefulness of the conventional crystal. The device takes the form of a cartridge with contacts at each end, mounted on an insulated base with binding posts.

Filkostat, a Filament Control

IN the Filkostat, a new filament control just perfected by S. R. Hipple, well known as an inventor of apparatus for the control of electric currents, there is presented an instrument which is distinctly designed to utilize the great tuning possibilities



Filkostat—a new filament control

of the vacuum tube itself. The Filkostat permits perfect regulation of filament heat. This governs the flow of electrons. Proper control of the electronic flow in the tube permits the very finest tuning conceivable.

The Filkostat has a definite off position. It is so designed that the filament extinguishes abruptly, indicating that the A battery supply is completely disconnected. At full on the Filkostat, resistance is practically zero.

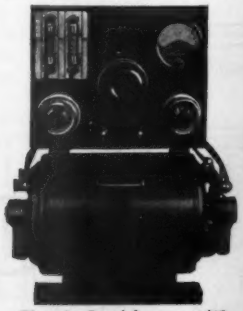
The Filkostat consists of a hollow cylinder containing the special resistance material placed between two large adjustable contacts controlled by turning the knob.

The resistance element is so finely divided that no further division is possible. There are no disks to break or chip.

The resistance remains constant at any position eliminating current variations once set. The Filkostat, which will retail for $2.00 is being manufactured by the DX Instrument Company.

Motor Generator for Charging Batteries

THE efficiency of the motor-generator when used for charging storage batteries, and its great flexibility in permitting



Electric Specialty generator

charging of batteries of varying voltages, at widely different rates, has led to the construction of a new Electric Specialty motor-generator set. The set is of the two bearing type and is supplied with or without a panel containing voltmeter, ammeter and control switches. The sets are rated at 100, 200 and 300 watts.

Resiston-Radion, a New Insulating Composition

THE manufacturers of the well-known Radion panels and parts for radio use have just announced that further improvements have been made in the composition of Radion, which produces an even better grade of material from the standpoint of its electrical and mechanical advantages. This improved product will be known, henceforth, as Resiston-Radion—Resiston being the trade mark adopted and registered by the American Hard Rubber Company for sheet or moulded material compounded for electrical insulating purposes, including radio apparatus.

Fifteen convenient stock sizes of Radion panels have been put on the market. This is an addition of five stock sizes over the number they have been manufacturing for the past year. Developments in the radio industry have indicated that fifteen stock sizes fulfil almost every demand of the man who builds his own set, and greatly simplifies distribution by jobber and dealer alike. Beginning at the smallest panel, 6 x 7 inches, they appear in increasing lengths, such as 6 x 10½, 6 x 14, 6 x 21, 7 x 18, 7 x 24, 10 x 12 and 12 x 14. The smaller sizes are 3/16 inches thick while the larger sizes, as 14 x 18 and 20 x 24 can be had in 3/16 and ¼ inch thickness.

H. R. Van Deventer Now With Dubilier Condenser and Radio Corporation

H. R. VAN DEVENTER, formerly with the Westinghouse Electric and Manufacturing Company, has been appointed vice-president of the Public Condenser and Radio Corporation. Mr. Van Deventer will be in charge of research, development and manufacturing.

Charging B Batteries from the Tungar

THE large numbers of users of the Tungar rectifier for charging 6-volt storage batteries are appreciating a new attachment for this charger by which it may be used for charging 22½-volt B batteries of the storage type. The attachment consists of a small porcelain spool wound with resistance wire and enclosed in a small sheet metal box, which can be hung on the side of the Tungar. Two connection leads come from the resistance, one going to the Tungar and the other (the longer) to the positive pole of the "B" battery. It can be attached in a few seconds, and without the slightest difficulty. It will charge a 20-24-cell storage "B" battery at approximately .1 ampere, or 10-12 cells at approximately .2 ampere. It can be removed easily and quickly for charging the "A" battery.

To meet the rapidly growing demand for the Tungar, brought about by its popularity for charging batteries used for radio, the factory facilities for manufacturing the smaller sizes have been greatly increased.

A New Battery Charger

A NEW type radio and automobile battery charger for convenient home use has been announced by the Valley Electric Company.

The new model has been designed so that it is suitable for installation and use in any

The Valley battery charger

room in the home. Similar in appearance to the watt-hour-meter, it is enclosed in a molded glass cover, which shows all working parts. No bulbs are used.

The Valley Type A and B charger will charge a 6-volt A radio battery or any make automobile battery at a 5-ampere rate. It will also charge 22½-volt and higher voltage B radio batteries.

This new model charger plugs in on the home lamp socket just like the ordinary electric light bulb. It connects to the battery by means of clamps, which are furnished with the instrument.

Knott Cinq Coil

ONE of the most interesting and ingenious tuning instruments that has been placed on the market is the Knott Cinq-Coil, which, as students of French and Spanish will surmise from the name, contains five coils. These coils are all arranged one within the other, and are governed by three concentric knobs, working independently of each other. The manufacturer, the Knott Machine Co., 1 Ellery Street, South Boston,

The Knott Cinq coil

Mass., states: "The loose coupling is so divided that instead of 90 degrees of one dial adjustment, as on the ordinary variocoupler or variometer, there are 120 degrees on each of three dials, multiplied by the fact that the change of position of each one affects the others, so the adjustment is stretched 1,000 times. This means, of course, that whereas in the old style of single rotor you might get four stations in ¼-inch of your dial, you have on this Cinq-Coil those same stations spread over several inches of adjustment. You thus eliminate interference and obtain clear accurate tuning.

"When all the dials read zero, the five coils are directly one inside the other with the same center line. The three dials are Knott positive stop dials. Wires are carried from each coil to binding posts. The outside coil and number three coil are wound for taps to be taken off every few turns if you desire. Numbers one, three and five are the rotating coils, each moved by its knob, independently of the others."

Tube Sockets

RADIO fans who have wondered why the various tubes have different types of base, so that one tube cannot be used in the socket indicated for another, will be interested in the following explanation, which the makers of the Na-Ald socket make to those who inquire of them.

"There have been no changes made in tube design without a real reason for changing. The size of the WD-11 tube lends itself to a smaller base. The variation in the size of the prongs and peculiar location insure the tube being placed in the socket with the proper connections and prevent its being burned out by being placed in a socket of sets using a 6-volt battery.

"The same reason for changing the size of the base also applies to the new G. E. 199 tube that works from two dry cells.

"However, the most interesting change for added efficiency is in the changing of the plate and grid terminals. In the regular 6-volt tube Nos. 200, 201 and 201-A, the plate and grid terminals are side by side. In the Westinghouse WD 11 tube and General Electric Company's No. 199 tube, the plate and grid terminals or prongs are opposite each other. This elimination of capacity between these two terminals adds a great deal to the efficiency of these tubes. To get the full benefit of this efficiency it is advisable to use sockets designed especially for this tube. Some manufacturers have simply made over the mould for their regular sockets necessitating changing of connections underneath. To do this they must run close to each other and this restores the capacity effect to a serious degree. This same objection is also found in all adapters, as it is necessary for the connection to cross over and run in close proximity to each other."

For that reason the use of special sockets rather than adapters is recommended by the Na-Ald people. They point out that their WD-11 socket gives a wiping contact on the prongs in the base of the tube.

Underwriters Approve Ducon

THE Ducon plug, used for attachment to electric light sockets in order to use house wiring as an antenna, has been approved by the Underwriters' Laboratories for such service. The Laboratories submitted the plug to severe tests, mechanical and electrical, and found that it presented no fire danger. The plug, which is made by the Dubilier Condenser & Radio Corp., New York City, therefore may be freely used without danger of invalidating fire insurance policies, which is not the case with devices that have not had the approval of the Underwriters.

The Monthly Service Bulletin of the

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi, *President* — J. Andrew White, *Acting President* — H. L. Welker, *Secretary*

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HEADQUARTERS: 326 BROADWAY, NEW YORK

IN the February issue of THE WIRELESS AGE mention was made in the reports on the trans-Atlantic tests of last December by the French, of signals from station Zero-MX which at that time had not been identified. THE WIRELESS AGE has had this transmission confirmed in a recent letter from an amateur in Holland, whose name is omitted for obvious reasons. He states in his letter, that he assigned that call O-MX to his station because he was unsuccessful in obtaining any designation of it officially from the Postmaster General of his country, and because amateurs are not permitted to transmit in Holland. He does not explain, however, how he kept out of jail in the proceeding. The operator of O-MX states that he is going to carry these tests further as long as possible, and states that he will call "NAWA sign O-MX" each Saturday night at 11 o'clock, Greenwich Mean Time, on 240 meters using a C. W. transmitter, until further notice, and requests advices if any amateurs hear his signals.

O-MX in his letter states that he would like to live in America as it must be a "heaven" for radio amateurs. It may seem that way to him, but to any one who has listened recently on 200 meters in this country, there might be a different feeling about it. In fact, this feeling might be so entirely different as to suggest just the opposite.

THE WIRELESS AGE will appreciate any advices regarding reception of O-MX if the signals are heard by any of its readers.

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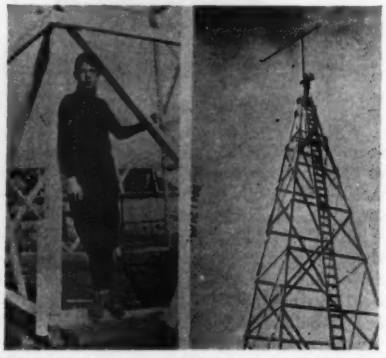
THE design and operation of station 9AAP, Milwaukee's only station to have its signal span the Atlantic, was the subject of a paper presented by Marian Szukalski, Jr., at the first meeting in February of the Milwaukee Amateurs' Radio Club. E. G. Nickel and E. A. Cary, both of station 9ATO, as members of the club's publication committee, frequently give digests of current radio literature in their reports, one of these being a most interesting and instructive description of the design and operating record of station 6KA.

C. N. Crapo announced in his monthly report that Milwaukee County, the smallest of the districts, with four hundred and fifteen messages handled, ranked second in the race among traffic districts of the State.

To the stations which monthly handle the greatest amount of traffic a silver cup, known as the Wisconsin Cup, is offered by B. A. Ott, 9ZY, manager in charge of the



Fifteen-year-old Peter Black, Jr., of Prince Rupert, B. C., and the 120-foot wooden aerial tower which he built to enable him to hear Honolulu and San Francisco

State. Members of the Milwaukee club are now out for this honor.

City manager I. H. Strassman, 9AHO, advised members of the presence of several local unlicensed stations in the air, and that he and his staff were taking steps to locate them and clear up the situation.

Incorporation of the club under the laws of the State of Wisconsin was the second case assigned to Attorney L. J. Topolinski, the society's general counsel.

Business Manager L. S. Baird has opened negotiations with both the South Side and West Allis radio clubs with the object of bringing about consolidation with the Milwaukee club at the time of incorporation and forming one large county radio association.

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THE City College Radio Club, 2XNA, is open to visitors daily except Sundays from 1 to 2 p. m., and may be found in the bell tower in the main building at 139th Street and Convent Avenue, New York City. This is the room that, during the war, was one of the U. S. Navy radio compass stations, and was used for position finding, particularly of enemy transmitters. It still contains the original loop antenna used by the Navy. A regulation 200-meter aerial is stretched between the two towers of the main building—one of which is the bell tower—and a two-wire receiving aerial, about 150 feet long is stretched from the main tower. Lately a counterpoise has been added to the aerial system.

Upon entering the "radio cabin" one may perceive on one side, the code table equipped with buzzers, keys, and an automatic tape transmitter. Here also may be found the latest issues of the leading radio magazines, and the "log" which every member signs as he enters and leaves the room. On the other side of the room, the sending and receiving outfits are located. The transmitter may be used for wireless telephony, continuous wave telegraphy, or buzzer-modulated telegraphy. Four 5-watt power tubes are used. The receiving set consists of a short wave regenerative receiver, a 2-step amplifier, and one step of power amplification, and a Magnavox. All the instruments are inclosed in cabinets with panel fronts.

During 1921, the club, conducted experiments in broadcasting music and song as well as reporting the scores of the college games. Phonograph selections and college songs sung by the members were broadcasted without any difficulty. Mandolin and banjo-mandolin music was also transmitted and favorable reports were received from those who heard it. The banjo-mandolin music furnished by Operator Fusco was especially appreciated. Last Fall, during the exciting C. C. N. Y.-N. Y. U. football game in the College Stadium, Radjo Club members were on the side lines with a field telephone connected to the station in the bell tower. There, an operator repeated the plays as they were reported into the radiophone transmitter.

On January 1, 1922, at 4 p. m., 2XNA broadcast its first Radiophone Organ Recital. While the noted organist, Professor Samuel A. Baldwin, was playing the organ before a large audience in the Great Hall of the college, the recital was being broadcast from the club's station in the bell tower on a wave length of 280 meters. Microphones attached to large megaphones were installed in the two organ lofts and connected in series. On January 22, the second radiophone organ recital was broadcast, following which letters were received from stations which heard the concert and appreciated it enough to notify the club.

Some of the club activities that can be briefly enumerated are daily code practice a weekly lecture by one of the advanced members or by some outside expert.

The club is working on an even more ambitious program for the year of 1922. Adopting as our motto, "Service to Alma Mater," it is going to show how useful a radio club can be in a college. Plans have been formulated for the building of a 250-watt set.

The officers of the club are: President, R. Carlisle, 2VY; Vice-Pres., M. B. Gillespie, 2CVN; Chief Operator, Ben Orange, 2CEC; Sec.-Treasurer, D. Weinbloom.

MR. John C. Gregory of Treadwell, Alaska, a new member of the National Amateur Wireless Association, while recently using a single circuit regenerative receiver in connection with a 2-stage audio-frequency amplifier, was successful in picking up the broadcasting program from PWX located at Havana, Cuba; the distance being approximately 4,000 miles.

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THERE is still great interest in amateur radio telegraphy. This fact is shown by the increase in general and restricted amateur licenses issued by the Department of Commerce since January 1, which number 601. On January 1, there were 17,102 amateur licenses in effect, and on March 1st, there were 17,603.

These figures do not include 617 other non-commercial stations, which comprise 134 technical and training school stations, 297 experimental and 186 special amateur stations.

The distribution of special amateur licenses by districts is as follows, showing the Chicago District, including Northern Peninsula of Michigan, Wisconsin, Illinois, Kentucky, Indiana, Minnesota, Iowa, Missouri, North and South Dakota, Nebraska, Kansas and Colorado. first:

District	Headquarters	Total, March 1
1	Boston	2490
2	New York	2589
3	Baltimore	1919
4	Norfolk	420
5	New Orleans	825
6	San Francisco	2019
7	Seattle	863
8	Detroit	2749
9	Chicago	3729
	Total..	17,603

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Harry Sadenwater Promoted by General Electric Co.

HARRY SADENWATER, former Assistant Radio Inspector, Second District, and former Lieutenant of the Air Service of the United States Navy, has been placed in charge of the technical operation of the broadcasting stations of the General Electric Company, including WGY at Schenectady, N. Y., and the projected station at San Francisco, Cal. The selection of Mr. Sadenwater was made by Martin P. Rice, Director of Broadcasting.

Two years before he entered the ranks of the Radio Engineering Department of the General Electric Company, Mr. Sadenwater was a Lieutenant in the United States Navy and was one of the few, out of hundreds of volunteers, selected for the hazardous flight of the NC flying boats, NC-1, NC-2 and NC-4, across the Atlantic, from Newfoundland to Portugal.

Lieut. Sadenwater was radio officer on the NC-1, which encountered heavy fog during the trip and finally came down to the surface of the sea and was so badly damaged by the waves that it was impossible to ride off the water. The crew was in imminent danger of going down with the NC-1 for several hours. Lieut. Sadenwater sent out SOS calls until the batteries became exhausted. Finally a Greek freighter, the SS. *Ionia*, sighted the NC-1 and picked up her crew and landed them safely at Horta Fayal, in the Azores. Lieut. Sadenwater, with other members of the crew, was made a Knight of the Military Order of the Tower and Sword by the President of Portugal.

Additions to Staff of C. Brandes, Inc.

L. W. STAUNTON, former research manager of the Herold-Garber Company, Indianapolis, Ind., has been appointed advertising manager of C. Brandes, Inc.

Previously, Mr. Staunton was in charge of the merchandising section, department of publicity, Westinghouse Elec. & Mfg. Company, in which capacity he had considerable responsibility in the production of radio publications. At the time the famous KDKA broadcasting station was established at East Pittsburgh, he was closely associated in radio

L. W. Staunton of C. Brandes, Inc.

work with Mr. M. C. Rypinski, who is now vice-president of C. Brandes, Inc., and therefore in joining the organization of C. Brandes, Inc., he is joining well-known friends in the radio field. Previous to his connection with the Westinghouse Company, he was affiliated with the publicity department of the Taylor Instrument Company, of Rochester, N. Y.

C. Brandes, Inc., has also recently appointed Mr. C. E. Brigham as research and design engineer.

Mr. Brigham has taken the course of radio at Harvard. He also took the course in telephony at the Naval School, at New London, Conn., and a four-year course in George Washington University in electrical engineering.

For two years Mr. Brigham was chief instructor in radio at the National Radio Institute at Washington, D. C.

STATIONS WORKED AND HEARD

Stations worked should be enclosed in brackets. All monthly lists of distant stations worked and heard which are received by the 10th of each month will be published in the next month's issue. For example, lists received by November 10th will be published in the December issue. Spark and C. W. stations should be arranged in separate groups.

2NE, A. H. SAXTON, and D. M. COLE, 211 Clarcmont Ave., Jersey City, N. J. (February). CW (unless otherwise marked).

1aaw, 1adn, (1akb), 1apc, 1aun, (1awe), 1ban, 1bes, 1bkq, 1boq, 1bom, 1bqq, 1brq, 1bvh, 1bwj, 1cab, 1cak, 1cbj, 1cmk, (1cmp), (1cpi), 1csj, (1fd), 1il, 1ow, (1rv), (1sn), 1ts, 1xm, 3adx, 3aro, 3bss, 3bwt, 3pz, 3su, 4agi, 4bi, 4hw, 4ik, (4lj), 4mb, 5es, 5js, 5pd, 5zas, 8adg, 8afd, 8ajx, 8alf, 8alo, 8alv, 8apw, 8atl, 8atn, (8atx), (8avt), 8bcy, 8bda (spk.), (8bjs), (8bnh), (8bvr), 8cfq (spk.), 8cin, 8cpx, 8cuu, (8cwp), 8cwx, 8cyu, (8dae), 8gp, 8gz, 8ih, 8ij, (8jj), 8jy, 8kh, 8nb, 8qk, 8ue, (8xap), 8zz, 9aap, 9aau, 9aih, 9aj, 9ajh, 9ako, 9amo, 9aog, 9aoj, 9ar, (9bgc), 9bnd, 9bkk, (9bta), 9cdu, 9cfz, 9cjc, 9cpi, 9cpx, 9ctv, 9cui, 9cxp, 9dbf, 9dio, (9dmj), 9dpp, 9duq, 9dvw, 9dyn, 9il, (9pq), 9um, 9vb.

CANADIAN—2cq, (3de), 3in, 3ko, 3si, (3sx), 3yh. Please report signals from 2ne.

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RAYMOND GROEBE, ELIZABETH, N. J. (February.)

C. W.—1aaw, 1aby, 1adj, 1agh, 1alj, 1alz, 1anm, 1anr, 1any, 1aoi, 1aoe, 1aov, 1atj, 1axi, 1ayz, 1ban, 1bas, 1bdi, 1bet, 1bfe, 1bfi, 1boa, 1bqk, 1bsa, 1bvb, 1bvh, 1bvr, 1bwj, 1byn, 1cab, 1cac, 1cah, 1cdo, 1cmk, 1cmp, 1cnf, 1cnr, 1cot, 1cpj, 1cpn, 1csw, 1cve, 1cxx, 1aw, 1cc, 1dq, 1ez, 1fm, 1gs, 1iv, 1mc, 1my, 1qp, 1sd, 1tl, 1vg, 1wc, 1xk, 1xm, 1xu 1xx, 1ze—3aao, 3acr, 3adq, 3aef, 3ahp, 3ajj, 3amw, 3apj, 3apo, 3apt, 3aqr, 3aro, 3arv, 3asp, 3atb, 3auv, 3awa, 3awh, 3bdm, 3bei, 3bfu, 3bfz, 3bgf, 3bmo, 3bob, 3bof, 3brw, 3bsb, 3bss, 3buc, 3bup, 3buv, 3buy, 3bvc, 3bwj, 3can, 3ccc, 3ccv, 3cdy, 3cel, 3cc, 3de, 3dh, 3fm, 3fq, 3fs, 3gc, 3hi, 3hx, 3ih, 3id, 3kl, 3lk, 3lp, 3od, 3oe, 3oj, 3ot, 3rf, 3ss, 3st, 3tj, 3tr, 3uc, 3wx, 3xa, 3xm, 3xn, 3xt, 3yh, 3yk, 3yo, 3zo, 3zw.—4as, 4bg, 4bi, 4bq, 4by, 4db, 4dc, 4dt, 4eb, 4eh, 4el, 4ep, 4fe, 4ft, 4hw, 4hz, 4ir, 4iw, 4jk, 4kl 4kq, 4lj, 4mb, 4nv, 4od, 4oi, 4xd, 4ze. 5da, 5ek, 5fe, 5ik, 5jb, 5kc, 5lf, 5ns, 5nz, 5pv, 5px, 5qm, 5qy, 5sf, 5tc, 5uk, 5xb, 5xk, 5xt, 5zak, 5zas.—8aaf, 8aak, 8adk, 8aeo, 8afd, 8aia, 8aik, 8aiz, 8ajt, 8akd, 8alf, 8alo, 8anb, 8ang, 8aoh, 8apv, 8asc, 8aue, 8avt, 8awv, 8awz, 8axn, 8azc, 8bch, 8bda, 8bdb, 8bef, 8beo, 8bgj, 8bjc, 8bms, 8bog, 8boz, 8bqc, 8brc, 8brd, 8brt, 8bry, 8bsf, 8bws, 8bwy, 8bxf, 8bxx, 8bzq, 8cab, 8cbk, 8cef, 8cei, 8ahb, 8chu, 8cix, 8cjh, 8cjy, 8cjz, 8cko, 8clz, 8coi, 8con, 8cow, 8cpx, 8cqx, 8ctn, 8cvx, 8cxh, 8cxp, 8cyu, 8czr, 8dag, 8dak, 8xap, 8zae, 8ab, 8cp, 8eo, 8er, 8fu, 8ii, 8ij, 8jj, 8kh, 8ku, 8lh, 8ls, 8qk, 8rj, 8sf, 8te, 8uc, 8uf, 8vl, 8vn, 8wa, 8zd, 8zo.—9aal, 9aau, 9aek, 9aey, 9afk, 9aix, 9alp, 9amh, 9amt, 9amu, 9anf, 9aon, 9aps, 9ase, 9aza, 9bam, 9bda, 9bdb, 9bed, 9bee, 9bgb, 9bgh, 9bgi, 9bgy, 9bij, 9bjr, 9boe, 9bre, 9brj, 9brx, 9bwn, 9bxc, 9bzi, 9bzz, 9cba, 9ccs, 9ccv, 9cdu, 9cfk, 9che, 9cja, 9ckw, 9cmf, 9cnv, 9cpg, 9cve, 9cvi, 9cym, 9cyp, 9cyw, 9dah, 9dbf, 9dct, 9ddy, dio, 9djb, 9dqa, 9dri, 9dro, 9dsd, 9dwf, 9dwq, 9dxc, 9dxe, 9dxn, 9dyn, 9ehi, 9eki, 9as, 9cr, 9ei, 9ep, 9fp, 9ik, 9il, 9lh, 9me, 9oc, 9of, 9or, 9ox, 9pe, 9pf, 9uu, 9vk, 9vm, 9yf, 9za, 9zt, 9zy.—CZ-7, AD-7. (Phone)—1bka, 1xak, 3fq.

All these stations were heard on a one step only.

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3RB, JAMES A. and JOSEPH M. NASSAU, 1510 N. Gratz St., Philadelphia, Pa. (February).

1ap, 1aw, 1cn, 1fh, 1gs, 1gv, 1ii, 1mc, 1my, 1ow, 1py, 1qp, 1sd, 1sn, 1xk, 1xm, 1yd, 1yk, 1xxd, 1aaw, 1abb, 1ajp, 1ajx, 1aoj, 1ary, 1atj, 1aun, 1awb, 1ban, 1bdi, 1boe, 1boq, (1bqd), 1brq, 1bsp, 1bvh, 1bwj, 1cac, 1cdo, 1cik, 1civ, 1cja, 1ckp, 1cmk, 1cmp, 1cmf, 1cpn, 1csw, (2bxp), (2ckl), (3cdy), (nof), 4bi, 4dc, 4ea, 4ft, 4gz, 4ik, 4kl, 4mb, 4nv, 4ya, 4zc, 5da, 5fv, 5kc, 5mo, 5qm, 5sm, 5xa, 5aab, 5aag, 5zas, 6zz, 7hd, (8apw),

(8cxw), 9bp, 9ei, 9ep, 9fp, 9ii, 9il, 9lh, 9lz, 9of, 9or, 9ox, 9pc, 9pe, 9uc, 9ur, 9uu, 9ve, 9vk, 9vm, 9vz, 9yb, 9zn, 9zt, 9aap, 9aas, 9aau, 9aav, 9adf, 9aen, 9aeq, 9afk, 9aho, 9amh, 9ami, 9ane, 9anq, 9aog, 9aps, 9atn, 9aus, 9avc, 9awf, 9bch, 9bds, 9bed, 9bhd, 9bhi, 9bjy, 9brk, 9buh, 9bxc, 9bzi, 9cba, 9cbs, 9cbt, 9cck, 9cdu, 9cev, 9cjj, 9cjm, 9cpa, 9cte, 9ctv, 9cui, 9cvo, 9cwc, 9cwr, 9cyw, 9czf, 9dax, 9dcr, 9dgq, 9dgv, 9dhs, 9dio, 9dkk, 9dvn, 9dxe, 9dzy, 9ece, 9eco, 9xac, 9zaa, ad-7.

CANADIAN—3bp, 3bq, 3co, 3dh, 3fc, 3gk, 3jl, 3sx, 3xn, 3zs, 9aj, 9al, (9bj), 9bs.

8OM, BURTON MARKS, 25 Tennyson Ave., Highland Park, Detroit, Mich. (February.)

C. W.—1ar, 1my, 1oi, (1rd), 1xm, 1yd, 1ajp, 1asj, 1bas, 1bwj, 1cmk, 2gk, 2awf, 2bbb, 2bys, (2bzv), 2cqz, 3de, 3km, 3mb, (3pz), 3zo, 3aqr, 3bof, 3bss, 3buc, 3xal, 4eb, 5ek, 5mo, 5pv, 5px, 5rh, 5xk, 5zs, 5aby, 5zas, (8apw), (8bjs), (8but), (8cgx) (8ctn), 9ba, (9ce), 9ep, 9ez, 9ne, 9ox, 9sh, 9iz, 9aap, 9aru, 9arz, 9aix, 9aey, 9aou, 9aim, 9afk, 9ajh, 9aza, 9aqz, 9aps, 9aog, 9aod, 9bop, (9brk), (9bkj), 9bzi, 9bvz, 9bak, 9cks, 9cui, 9cgk, 9cjc, 9cip, 9cao, 9cmd, 9clq, 9dqv, 9dvw, 9dxd, 9dsd, 9yf.

Canuc C. W.—(3bv), (3dh), 3ko.

9BXT, ELVIN B. CHAPMAN, Giltner, Nebr. (February).

C. W.—1mc, 1qp, 1qr, 1rv, 1sn, 1wc, 1xu, 1abb, 1ajp, 1ajx, 1alz, 1apc, 1azl, 1ban, 1bkq, 1boe, 1cak, (1cmk), 2el, 2fp, (2gk), 2hj, 2kf, 2nz, 2rm, 2rz, 2alj, 2bmr, 2bqh, 2brb, 2ccd, 2cgt, 2cqz, 2cxl, 3fq, 3hg, 3hs, 3jj, 3km, 3pz, 3su, 3wf, 3xm, 3ajj, 3aln, 3alt, 3aro, 3bjy, 3blf, 3bvy, 3cqz, 4ag, 4bk, 4bq, 4bx, 4co, 4db, 4do, 4eb, 4eh, 4el, 4fa, 4fg, 4ft, 4gz, (4hw), 4hz, 4ik, 4jh, 4kl, 4yu, 4lo, 4mb, 4od, 4oi, 4ya, 4yd, 4zc, 4zn, 5bp, (5bw), 5de, 5di, 5ek, 5en, 5fv, 5hh, 5ho, 5iq, 5jb, 5jl, 5jn, 5js, 5kc, (5ki), 5kk, (5kw), 5mo, (5nn), 5ns, (5nv), 5nz, (5ov), 5pb, 5px, 5qi, (5rn), 5sp, 5sr, 5ss, 5ta, 5tc, 5tj, 5uk, 5uo, 5us, (5xb), 5aag, 5aam, 5aaq, 5aar, 5abm, (5aby), (5adb), 5ade, 5adf, 5ado, 5aec, 5afq, 5agn, 5ahd, 5aib, (5ajc), 5xac, 5xaj, 5zae, 5zaf, (5zak), 5zaw, 6ea, 6jx, 6ku, 6ol, 6ti, 6wm, 6xk, (6zh), 6zn, (6zt), 6anh, (6aqp), 6aqw, 6asj, 6auu, 6awt, 6awx, 6bbv, 6bcj, 6bcl, 6bjq, (6boe), 6bqg, 6bqw, (6bsq), 6buy, 6bvf, 6bvg (6caj), 6cec, 6axd, 7bj, 7hm, (7ln), (7lu), 7nf, (7ot), 7sc, 7we, 7zf, (7zn), 7zv, 7abb, 7ado, 7afo, 7aiy, 8aa, 8ag, (8cf), 8eo, 8fc, 8gz, 8hc, 8hn, 8jj, 8kh, (8kj), 8on, 8pj, 8rj, 8rr, 8tx, 8uf, 8vq, 8wx, 8wy, 8xe, 8yk, 8yy, 8zd, 8zn, 8zo, 8adg, 8adz, 8afd, 8aig, 8aim, 8amp, 8anb, 8aol, 8apv, 8aqc, 8aqv, 8asv, 8atc, 8atn, 8awz, 8axn, 8azg, 8bda, 8bdv, 8bek, 8ben, 8beo, 8bfb, 8bfq, 8bfx, 8bgl, 8bjs, 8bnz, 8brq, 8bry, 8bxa, 8bxh, 8bxx, 8byo, 8caa, 8cab, 8cbc, 8cdz, 8cfo, 8cgj, 8chb, 8cik, 8cjc, 8cjz, 8ckv, 8clk, 8con, 8cow, 8cpb, 8cpx, 8cpy, 8crt, 8cuo, 8cvx, 8cxf, 8cxw, 8cyt, 8cyu, 8czc, 8dag, 8dai, 8dat, 8zae, (9fp), (9if), (9mc), (9ur), (9us), (9vm), (9wi), (9xt), (9abu), (9adf), (9atp), (9avc), (9ayd), (9bcf), (9bdu), (9bdz), (9bhi), (9bkc), (9bop), (9bvy), (9bwe), (9bxa), (9bxb), (9bxc), (9bxm), (9bxy), (9caa), (9cbl), (9cde), (9ciy), (9cjj), (9cki), (9clf), (9clh), (9cmk), (9cpg), (9ddy), (9dhi), (9duq), (9eak), (9ecs), (9ehc).

CANADIAN—2af, 3in, 3jl, 3jt, 3ko, 3ni, 3ta, 3zs, 4ab, 4bv, (4cn), (4dk), 4dq, 4hh, 9bp, 9bx.

SPARK—(7ex), (9bug), (9bwj), (9clf), (9dnc), (9dxt).

Queries Answered

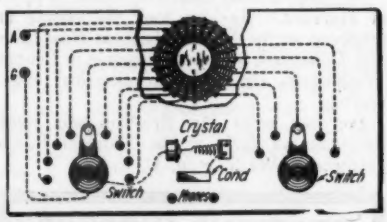
Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no questions answered by mail.

W. E. Snyder, New York City.

Q. The writer wanting something to read a week ago bought THE WIRELESS AGE of February. It was very interesting reading to the writer. Having a nephew 11 years old who wants to be a radio expert he discovered the article by Stuart Babcock on page 74. Now he wants the writer to build it for him and of course when a kid wants a thing he wants it. The writer not being familiar with radio is writing to you for some information to get a more detailed account of the article. In the article the sentence: "Figure 1 shows the completed form with half of the toothpicks in position." The sentence to the writer is rather vague. If the coil is made as the writer thinks, it will be flat, and how will the switches work on a flat surface. To the writer's way of thinking the five dots or switch contacts on the right when in a circle will be in back of the 9 switch contacts. If so, how is the coil held?

A. The switches do not move over the surface of the coil at all. This surface is not flat but wavy because the wire is interwoven with the toothpicks. The switches and switch contacts are mounted on a panel—the contacts being connected to the coil by means of the loops which are taken out of the coil every 5 turns, and every single turn for the last 5 turns of the coil. See diagram for layout of set.



We would urge you to read some of the elementary radio books such as "An Introduction to Radio" published by the Wireless Press.

* * *

H. R. Hall, Perry, Iowa.

Q. I am planning on changing my set over to use spider web coils and want to use the diagram that was printed in the January issue of THE WIRELESS AGE in answer to Mr. Rodda's question, but want to know if I can build a set of coils to receive the signals from the station at Arlington, Va., and also the Great Lakes station, and how many turns would each one require and what size wire would it take?

A. In order to receive longer wave lengths, the coils should contain 300 turns for primary and secondary and about 100 turns for the tickler. Use No. 24 or No. 26, S.S.C. wire. We would recommend the use of another form of winding for these wave lengths than spider web since the coils would become very large—of the order of 12 inches in diameter. You will find data on the design of long wave coils in E. E. Bucher's "Wireless Experimenter's Manual," published by the Wireless Press, New York.

* * *

Rolf A. Pearson, Port Chester, N. Y.

Q. Will you please give me the very best hook-up that you know of for a radio receiving set to be installed in an automobile, using a loop antenna? The number of bulbs or parts are immaterial. What I want is a good receiver to work a loud speaker and bring in distant stations.

A. The best hook-up for using a loop antenna on an automobile is one containing six tubes—three radio, detector and two audio. You will find complete data on the construction of such a set in the July, 1922, issue of THE WIRELESS AGE.

* * *

J. R. Hoover, Elmira, N. Y.

Q. 1. In your issue of THE WIRELESS AGE for January, you published a number of "Practical Reflex Hookups." In hookup described in figure 3 of that issue, a 50,000-ohm resistance is used. This resistance I have been unable to procure. Will you kindly advise me as to where it may be purchased?

A. 1. The 50,000-ohm resistance is a Western Electric Co. lavite resistance unit No. 38A and may be procured from the Continental Radio and Electric Corporation, 15 Warren St., New York City.

Q. 2. This hookup also requires a 10 M.H. choke coil, which should be used on an open core or an iron core?

A. 2. A honey-comb coil or one of the windings of a radio frequency transformer may be used for the 10 M.H. choke coil.

Q. 3. Will you please give the capacity of the variable condensers used in this hookup?

A. 3. The variable condensers have a maximum capacity of about .005 mfd.

* * *

Wm. Sacher, Pottstown, Pa.

Q. May I ask you what is wrong with my set? The set consists of three radio and detector and two of audio. I am using an Atwater-Kent circuit tuner and two 43-plate condensers. The best I ever received was Kansas City and got it through the loud speaker as loud as Schenectady. During the late hours I use the head phones but can't reach further than Kansas. Why is it the less voltage of "B" battery on the plate the louder it gets? I get nothing on voltage of 90 volts or upwards. Sometimes I get better results from the ground alone without the aerial. I built the set myself and bought nothing but the best parts. It was duplicated from the "M. P." ready-made set. This set always squealed and howled and was not a bit sensitive. I have my aerial on top of our building—fifteen feet above the roof. It is of the L type. The building is 75 feet high. Will you please give me the latest and most up-to-date hook-up that will give me results for the parts I have?

A. We would recommend that you use a 23-plate condenser and a vernier across the secondary of your coupler. The finer tuning will probably enable you to bring in more distant stations. Try interchanging tubes and try different tubes such as the UV-UV-201A which are far superior to the UV-201. Try different detector tubes. Try using a loop instead of the regular aerial. For in-

formation on loop and r. f. circuits, look up the July 1922, WIRELESS AGE. You get worse signal with 90 volts because the voltage amplification of the tube is reduced unless you apply a negative bias to the grids of the amplifier tubes.

* * *

Rev. Clarence E. Woodman, Berkeley, Calif.

Q. Kindly give me the natural wavelength of an aerial four wires, two feet apart, each from each; forty-seven feet above ground, one hundred and four feet long. The lead-in is twenty-six feet to receiving set. The lead-out is forty feet to a water pipe in the basement of my house.

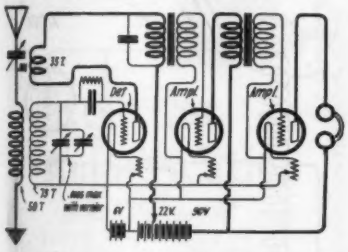
A. The natural wavelength of your antenna is approximately 200 meters. This figure is only correct to about 10 per cent. as there are a number of factors which enter, such as presence of trees, nearby buildings, etc.

* * *

A. G. Rosberg, New York City.

Q. 1. What is the best hook-up for my set, as outlined below?

A. 1. Below is a three-circuit regenerative receiver, using honeycomb coils.



Q. 2. If you approve of the Flewelling hook-up what grid leak condensers would you recommend?

A. 2. The Flewelling circuit is a regenerative circuit in which super-regeneration is effected by the discharge of a large condenser through a resistance. The latter produces the variation frequency which is necessary. We would advise you to look up the back numbers of THE WIRELESS AGE for explanation of super-regeneration. These local discharges are rather troublesome and we would advise using a standard regenerative hook-up which will give practically equal results. In fact, most experimenters find that all the large condensers are unnecessary; the circuit then being simply that of an ordinary regenerative receiver. Any standard make of grid leak and condenser is suitable such as Radio Corporation, Dubilier, Freshman.

Q. 3. Who is KFB?

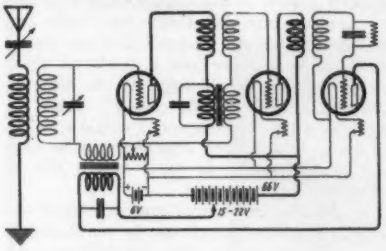
A. 3. KFB is the S. S. *City of Atlanta*, of the Savannah Line.

* * *

B. E. Litts, Ellendale, N. D.

Q. As per your request of February 17th, I am enclosing a complete diagram of reflex circuit referred to. I have tried to be explicit and the drawing is exactly the way I hooked up the circuit. But could not get it to function. I could get howls and tube noises, but nothing audible. I do not know of anything I can tell you further. But perhaps on looking over the diagram on opposite side you will detect something that will put some light on my failure. The .0002 mfd. condenser which you mentioned was simply an error on my part in writing, as I used .002 condensers in the four places shown in the diagram. I coupled everything very short.

A. We would advise you to disconnect the tickler coil and to use a 2-circuit tuner instead of the single circuit. Try adjusting filament and plate voltage of detector tube. See diagram below.



Roy Drew, Toronto, Ontario, Canada.

Q. I am trying to build a battery, as per the description given on page 41, chapter 17 in your book "Practical Amateur Wireless Stations." In your article you say, "In one end of each strip fill the holes with a red lead paste, and in the opposite end of each strip fill the holes with a similarly prepared paste of yellow lead." Now, sir, it is that yellow lead which I cannot definitely identify. One of the paint dealers thinks it must be a chromate, while battery men say it must be one of the oxides of lead. Will you please give me the chemical formula, so that I may be able to procure same?

A. The red lead in the positive plate has a chemical formula Pb 3 04. The yellow lead in the negative plate is commonly called lithrage. It is not a chromate—its composition being P60 (lead monoxide).

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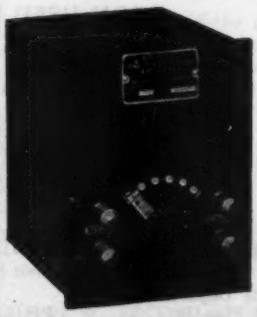

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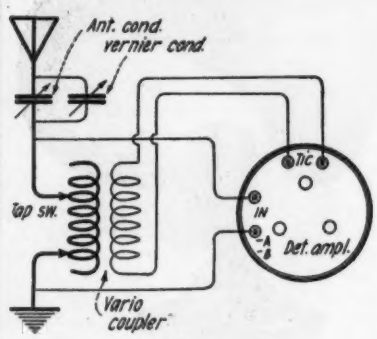
Frank Goodchild, Philadelphia, Pa.

Q. Kindly give me the information as to why, I don't get distant stations on my set. I cannot get anything outside of Philadelphia. I have a panel made by the Electro Dental Company of Philadelphia, with an inductance coil which is supposed to receive up to 1,200 meters and has ten taps on it. It has a 43-plate variable condenser and is hooked up with an Atwater-Kent detector and two-stage amplifier. I have an aerial of 19 stranded silvered bronze wire two lengths of 60 feet each, about 45 feet high. There are high tension wires passing by it about 40 feet away and also phone wires. I have my ground connected to a water pipe. I get Philadelphia broadcasting so loud I can hear and understand it plainly 20 feet away from the head phones. Please let me know what my trouble might be and what I can do to overcome it. Also let me know how to improve my set.

A. In order to receive distant stations with a non-regenerative receiver, your antenna should be very good and your coils of low resistance. It would be best for you to convert your set into a regenerative receiver in accordance with the diagram below, which will necessitate purchasing a vario-coupler and a vernier condenser.



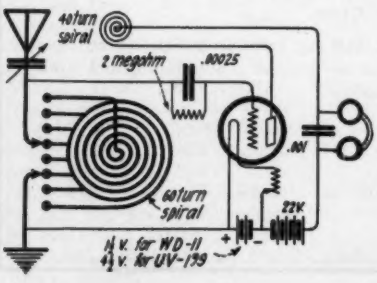
* * *

Theodore A. Nugent, Albany, N. Y.

Q. 1. In the December issue of THE WIRELESS AGE you give a description of how to make a 100-mile crystal receiver. I have made one and it works fine with WGY, Schenectady, N. Y., but no further. In the diagram there are two posts which are for connecting a bulb to the set. Would a peanut bulb do?

A. 1. A bulb certainly would increase the range of your receiver. If you make it regenerative, its range should exceed 1,000 miles under good receiving conditions. A peanut tube, such as the WD-11, or UV-199 would serve very well.

Q. 2. Please give wiring and description for setting up and what batteries are necessary.



A. 2. Below is hook-up for a regenerative set, using your coils.

* * *

Otto Sengpiel, Kansas City, Mo.

Q. After reading your article in the January issue of THE WIRELESS AGE on "Reflex Amplification" by A. Ringel, I have decided I want to build a set employing one of these circuits—the three-stage radio frequency with crystal detector and two stages audio reflex. Have you a book on these circuits, giving the ohmage of the different resistances used in this circuit? Also the capacity of the condensers; I would also like to know if a power amplifier can be used for loud speaker. If so, I would like to have hook-up for same.

A. All the resistances and capacities are standard articles which can be purchased in any up-to-date radio store. Their values are indicated in the diagrams or in the accompanying text. A power amplifier may be employed with the set. For hook-up see page 68 of the December, 1922, WIRELESS AGE.

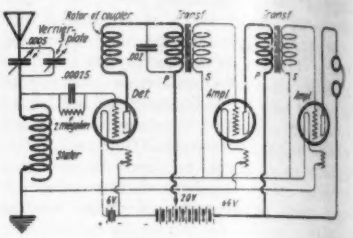
* * *

L. S. Sanders, Gassaway, West Va.

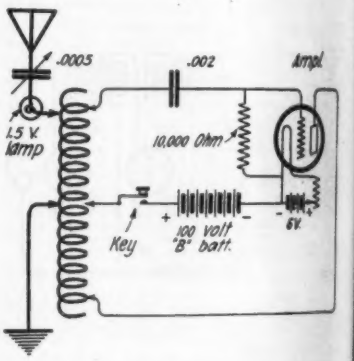
Q. I want to build a receiving set that will receive all the broadcasting stations in the East. The Y. M. C. A. here has a Westinghouse H. R. receiving set that does the work. I want to use in my set about the same as they use if you cannot recommend a better one. We have ideal conditions here with very little interference. What I would like to get is a blue print or drawing that would clearly tell me the parts to buy and how to wire same. I want to use one or two steps of amplification. If you can furnish me with this print and list of parts needed, I will appreciate it. Also I would like to know about sending and receiving sets for Boy Scouts that would have a range of, say, one mile. I am scoutmaster here and the boys want to use code.

A. Here is a circuit with two stages of amplification which is suitable. It is very easy of operation, and the practical results obtainable are generally satisfactory.

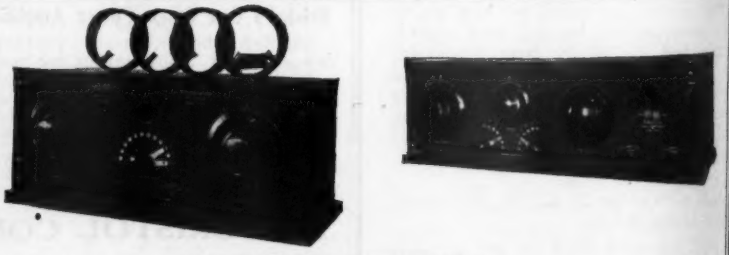
Material: .0005 condenser and vernier; 1 vario-coupler—about 60 turns of each winding; 1 grid condenser .00025 mf and 1 grid leak; 1 phone condenser .002 mf; 2 amplifying transformers; 3 rheostats; 2 switches and about 16 switch contacts; 1 6-volt storage battery—60-80 Ampere hr.; 1 UV-200 radiotron; 2 UV-201 radiotrons; 1 pair phones; 3 22-volt B batteries.



Below is hook-up for a C.W. transmitter which will give about 1 mile radius.



The coil contains 40 turns of No. 18 annunciator wire wound on a core 3½ inches diameter. Turns ¼ inch apart. Core 12 inches long. Take taps out every two turns. A 1½-volt flashlight lamp is used as antenna ammeter.



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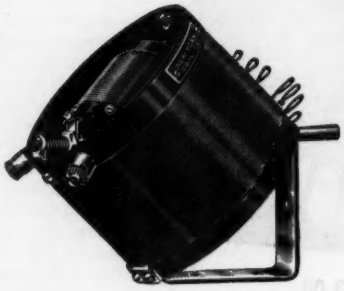

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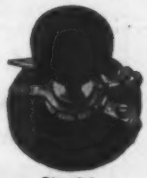
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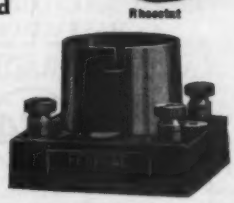
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Everything from the Antenna to the Phones
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The South's Largest Exclusive Radio Company
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Special Service to Dealers on Radio Corporation of America Products, in Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia, Virginia and West Virginia.

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WHOLESALE EXCLUSIVELY
Hommel's Illustrated Encyclopedia of Radio Apparatus 225 E will be sent free to dealers.
We sell to no others.

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Material purchased from a reliable manufacturer can be relied upon.

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Buying from a jobber who wholesales to dealers only insures you satisfaction for that jobber must please his dealers, who take 100% of his products.

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Lightning Arrester

Approved by Underwriters' Laboratories, latest Code. Carbon block types (not vacuum type) using a brown glazed porcelain case which can be installed inside or outdoors. Carbon block arresters have been standard in Railway signal and telephone protection for over 20 years. Ask your dealer or write us for special circular.

Price $1.10

Jewell Electrical Instrument Co.
1650 Walnut Street **Chicago**

NOVO "B" BATTERIES FOR RADIO

28½-45 & 105 VOLTS

NOISELESS
DEPENDABLE
GUARANTEED

ASK YOUR DEALER

NOVO MANUFACTURING CO.
424-438 W. 33rd ST. NEW YORK
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STERLING PORTABLE RECTIFIER

IMPROVED
Sterling
PORTABLE RECTIFIER

Don't Kill Your Battery With Improper Charging Devices

Charges from any 110-120 A.C. house lighting circuit. Only weighs 8 lbs. Supplied for 25, 50 or 60 cycle A.C. circuits.
List Price $16.00
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TRADE DISCOUNTS ON APPLICATION

OTHER STERLING RADIO DEVICES
Filament Rheostats — *Rotary Switches*
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Pocket Voltmeters for testing "B" Batteries

NO charging is often better than entrusting your battery to a rectifier of unknown qualifications.

Sterling Portable Rectifiers are guaranteed not to harm the battery regardless how they are used. Tapering discharge protects against overcharge. Either clip on the charging leads may be attached to either battery terminal.

"Freezing" and fusing eliminated.

Write for bulletin

The STERLING MFG. COMPANY
2845 Prospect Ave. **Cleveland, Ohio**
Over 3 million Sterling devices in use today.

Do not be confined to listening in on the nearby stations, when by installing the

Genuine and Guaranteed Capitol

"ALL WAVE COUPLER"

(Trade Mark) Patents Granted

in your set

you can receive remarkably clear and selective broadcast entertainment

From Stations

THOUSANDS OF MILES AWAY

and on any

Wavelength from 150 to 3000 Meters

without the use of variometers, vario-couplers, and loading coils.

Eventually—Why Not Now? If your dealer cannot supply you, send us your order and remittance together with his name.

Price $9.00

Beware of Imitations. Look for the Trade Mark "ALL WAVE" on the rotor, and the six efficient hook-ups packed in every box.

Six efficient and simple hook-ups sent free upon receipt of ten cents to cover cost of mailing.

Capitol Phonolier Corporation 56-60 Lafayette St., New York.

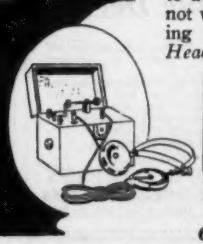
WHY METRO HEADPHONES ARE SUPERIOR

TRADE MARK METRO

MAGNETS

Permanently Sensitive!

Metro Headphones will always respond as distinctly to the slightest impulses as they did the day you purchased them. The magnets upon which their sensitivity depends, are made of highest quality tungsten steel, put through a special heat treatment, magnetized and then carefully "aged" to a uniform magnetic strength. These magnets will not weaken or lose their magnetism: If you want lasting sensitivity, you should insist on *Metro Headphones*, Price **$6.00**



Little Giant Receiving Set A surprisingly compact set. Cabinet, highly polished American Walnut finish. Simplest, easiest tuning device. Complete with Metro Headphones. **$14.00**

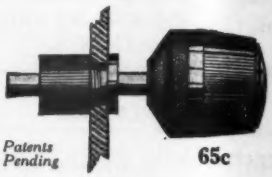
Metro Wave Selector Makes any set highly selective. Completely separates 360 from 100 meters. Adds only one control without changing set. Cabinet, highly polished American Walnut finish. **$7.50**

METRO ELECTRICAL CO., Inc.

Manufacturers of Metropolitan Radio Products

68 GOBLE STREET ! NEWARK, N. J.

FLERON VERNIER ADJUSTER



Patents Pending **65c**

An absolute necessity for close tuning. Improve your set with this ingenious little device. Easily mounted on any panel by drilling only one 5/16 hole.

Its normal position is away from the dial. A slight pressure causes bevel of soft rubber to meet bevel of dial. Vernier is then turned for accurate tuning.

FLERON PORCELAIN INSULATORS

No deterioration in the weather with Fleron Radio Porcelain insulators. Solid black glaze. No kiln marks or white spots. A size for every requirement. Each insulator packed in an individual carton. The only complete line.

No. 0	1⅜x3 long.....	.20
No. 1	1⅝x4 long.....	.30
No. 2	2⅛x3¾ (ball type).	.35
No. 3	1⅝x5 long.....	.40
No. 4	1⅝x8 long.....	.60

M. M. FLERON & SON, Inc.

Manufacturers

TRENTON, N. J., U. S. A.

Beeko Radio-Phono Phonograph Attachment

Sample by mail, 40c.

Liberal discount in quantities.

Send stamp for our 45-A Catalog now ready.

J. H. BUNNELL & CO.

32 Park Place

NEW YORK

How to Insure Sales for Your Product!

The chief asset of any business is the demand for its product. As long as that demand continues, the business is on a sure foundation. But let that demand subside, and every other asset of the business is in danger of becoming a liability.

IN times of prosperity and a rising market there is a general demand for the products of industry that comes to be accepted as a matter of course. It is seldom listed among the assets of the business—it is simply assumed that it will always be there.

But, overnight, conditions may change—as they have done before—and the matter-of-course demand becomes conspicuous by its absence. The business, once strong and flourishing, is suddenly found to be in a very tight place. *The demand had not been insured*—and yet the entire business depended upon its *continuance*.

The modern, economical way to insure the market for any reliable product is by Advertising to the public which consumes it. Advertising creates a steadily increasing number of customers who desire the product, and ask for it by name.

Changes in business conditions have little effect on a steady consumer demand for trade-marked articles of common use. The dealer may carry a lighter stock, and for a short time the demand through the jobber may seem curtailed; but just as sure as customers are calling on the dealer for the product, he is sure to supply it, and orders soon begin to flow in to make up for the temporary curtailment. The total consumption continues about the same.

Any manufacturer who has an article for popular consumption that can be trade-marked has the opportunity to insure his consumer market and retail sales by means of advertising.

During the present business condition the manufacturers who have insured their demand by Advertising are in a far better position—in every way—than those who have trusted to the current demand that was not of their creating.

Published by The WIRELESS AGE
in co-operation with The
American Association of Advertising Agencies

Double As Good

The scientifically correct design of the **Fada Vario-coupler** enables a very gradual variation of coupling over 180 degrees.

Ordinary couplers give only a 90 degree variation and hence the Fada 180 degree type has double the efficiency.

Its simplicity and high efficiency in signal selection by vernier control of coupling has given the Fada 180 degree coupler universal demand.

Vernier Rheostats

The nationally famous Fada Rheostat with a new vernier attachment.

No. 150-A Fada Vernier Rheostat....$1.25

Potentiometers

Mechanically perfect spacing and winding of the resistance wire resulting in smoother adjustment.

No. 152-A Potentiometer (200 ohm)..$1.00
No. 154-A Potentiometer (400 ohm).. 1.00

Fada ingenuity—manufacturing economy — value — guarantee — and low prices, are responsible for the popularity of Fada radio parts.

F. A. D. ANDREA
1581-C Jerome Ave.
New York City

The Fada Handbook gives facts about the use of each radio part, and will be of aid to you in your radio construction work. Send 10 cents for your copy.

Fada Equipment

"ESCO" BATTERY CHARGERS

To meet an insistent demand for

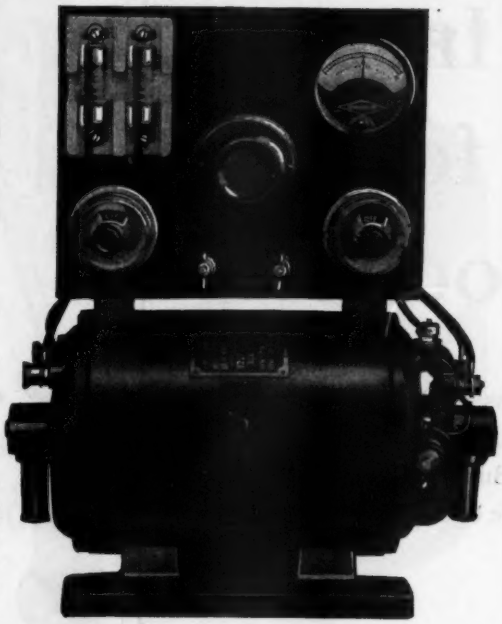
RUGGED—RELIABLE NEVERFAILING MOTOR-GENERATORS

For charging batteries used in wireless operation, we have developed a complete line of

MANY SIZES

with or without panel boards.

"ESCO" QUALITY thruout. You know what that means.



Ask for Bulletin 242

ELECTRIC SPECIALTY COMPANY

231 SOUTH STREET, STAMFORD, CONN., U. S. A.

Pioneers in developing Quality Wireless Apparatus

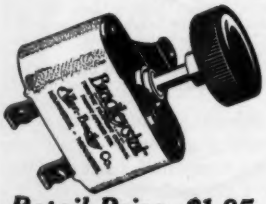
EXPERIMENTERS INFORMATION SERVICE

DESIGNERS OF THE HIGHEST CLASS RADIO APPARATUS IN THE WORLD

220 WEST 42nd STREET Twenty-third Floor NEW YORK CITY

ASK FOR CATALOG S

Pick Up those Distant Stations



Retail Price, $1.85

P. P.—10c extra
For sale by leading radio dealers

The tuning of detector tubes is such a critical operation that even the slightest movement of the ordinary rheostat knob will lose a distant concert or signal.

The Bradleystat, a guaranteed graphite disc rheostat, gives the most perfect vernier control with only one knob. Try one on your radio set. The improvement will be amazing.

Allen-Bradley Co.
Electric Controlling Apparatus

283 Greenfield Ave. Milwaukee, Wis.

Bradleystat

REGISTERED U. S. PAT. OFF.

PERFECT FILAMENT CONTROL

Uncle Sam's *Choice!*

Eight years of strenuous service in the U. S. Navy and Signal Corps have proved Bakelite-Dilecto (xx grade) supreme for radio insulation.

bakelite-dilecto!!

(A Laminated Phenolic Condensation Product)

Makes the *perfect* radio panel. Tough, durable and super-resistant.

Finished a smart, sleek black. Cannot warp. Machines readily.

Electrical men can get B D X X cut and drilled to your specifications.

The Continental Fibre Co.
Factory: Newark, Delaware

Dealer Service From:

New York, 233 Broadway; Chicago, 332 S. Michigan Ave.; Pittsburgh, 301 Fifth Ave.; San Francisco, 75 Fremont St.; Los Angeles, 411 S Main St.; Seattle, 95 Connecticut St.

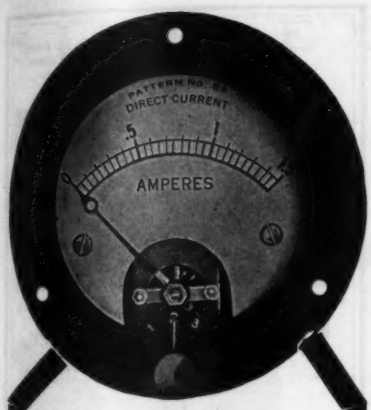
X X

RADISCO RADIO PRODUCTS

The Radio Distributing Co.

Newark, New Jersey

U. S. A.



Triplex Filament Meter

Filament control by the use of proper instruments in receiving sets is the trend of the times. The Jewell triplex filament instrument, made as an ammeter or voltmeter, places on your panel the proper means for controlling the filaments of three tubes. It has a self-contained mechanism for switching to either tube and being of small size, can be accommodated on the most compact tube set.

Price $10.00

We were the first to supply a complete line of miniature radio instruments of uniform size. Ask your dealer or write to us for complete radio circular.

Jewell Electrical Instrument Co.
1650 Walnut St. Chicago

Get on the subscription list of THE WIRELESS AGE and you'll be sure of getting your copy.

The Radiovox Company

Distributors of Radio Corporation and Western Electric Radio Apparatus

Operating Cleveland Broadcasting Station "WHK"

5005 Euclid Avenue
CLEVELAND OHIO

Kellogg Radio Equipment for Better Results

No. 69 A

The Kellogg rheostat is of simple design, having but one moving part. It is so arranged that a maximum contact surface is provided, making perfect contact. To assure perfect current to the most critical tube, the rheostat operates on the half turn of the resistance element.
No. 501.....Each $2.00

The value of extremely light and very small head sets in Radio receiving is most evident when using Kellogg head receivers, which, however, have proved as sensitive and thoroughly efficient as they are light in weight and small in size. The band, too, is especially adaptable and the simple receiver holders, which are held in place on the lower part of the head band by the spring tension of the metal, can be instantly adjusted so as to place the receivers over the ears for the best hearing.

No. 501

No. 69A Heat Set, 2400 ohms each.....$10.00
No. 74A Head Set, 1000 ohms each..... 5.00

Kellogg Radio jacks, plugs, condensers, variometers, tube sockets, dials, insulators, coils, variocouplers, microphones, etc., are the best that money can buy.

Kellogg Switchboard & Supply Co. Chicago

ANY OWNER OF AN EBY POST

Commander Ensign

will tell you he wouldn't take twice the price he paid for it if he couldn't get another.

EBY BINDING POSTS

not only excel all others in quality but it is impossible to lose the parts and they are surprisingly low in price.

Demand Them of Your Dealer

Corporal Sergeant

THE H. H. EBY MANUFACTURING CO., PHILADELPHIA, PA.

THE ACOUSTICAL AMPLIFIER

BEL-CANTO

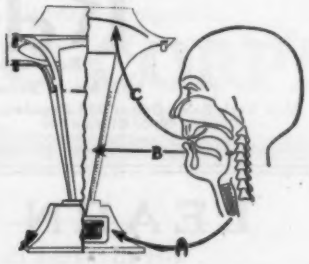
TRADE MARK

LOUD SPEAKER
Amplifies Without Distortion

Built along scientifically correct principles, following minutely the natural functions of the human throat. The unexcelled acoustical amplifier!

The receiver is the vocal cord (A); the long tapering inner horn is the throat (B); and the sounding board at the top is the roof of the mouth (C).

With this superlative amplifier you can readily distinguish the delicate tonal differences between a harp and a piano, even when the two are playing together. A test never before equalled.

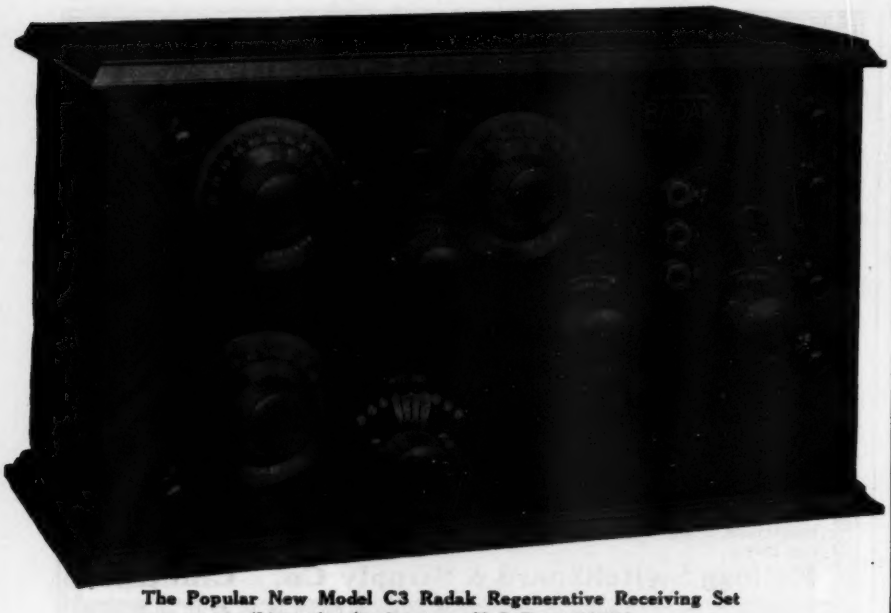


Is adjusted for regenerative two stages of amplification, also five tube radio and audio frequency.

Special phone, cord and plug, price $30.00 F. O. B. New York. If dealer can't supply, we can.

Full line of radio parts.

BEL-CANTO CORPORATION, 417 East 34th St., New York City



The Popular New Model C3 Radak Regenerative Receiving Set
(Licensed under Armstrong U. S. Pat. 1113149)

Gets Great Results

So many people want a beautiful cabinet containing an easily operated receiver and amplifier in one unit, that we are finding this new model of ours a very popular home seller. It is a handsomely designed case of figured American walnut containing a regenerative receiver and two stages of audio-frequency amplification.

Anyone can operate it and anyone can secure wonderful results. It receives wave lengths of 175 to 3000 meters, and its selectivity is surprising to say the least. May be used either with phones or a loud speaker.

We do not hesitate to recommend this newest set to the radio enthusiast of any grade of experience.

Size of cabinet 16¼ in. wide, 10 high, 3¼ deep. Employs the new Radak sensitive vernier dials. Retails for $100.

INTERESTING NEW BOOKLET

Send for the newest radio book. In addition to describing the newest Radak sets, it gives valuable information about radio which is not contained in other books. Free on request.

CLAPP-EASTHAM COMPANY
America's Oldest Largest Exclusive Radio Equipment Manufacturers
Makers of

Radak

Regenerative Radio Sets
101 Main Street, Cambridge, Mass.
New York Sales Office: 395 Broadway
Chicago, 33 S. Clinton St.
Pittsburgh, 332 Third Ave.
San Francisco, 709 Mission St.

Simpler, Sharper Tuning
with a

Warren Radio Loop

AERIAL and tuning device all in one.

Tunes not only to wave *length*, but to wave *direction*. An aid to selection. Eliminates atmospherics. All enclosed—dust and damp proof, fool-proof and surprisingly compact, neat and durable. Write today for Bulletin M 102, containing hookups.

A Type for Every Set at the Best Dealers

Type A-737 (300-700 meters) 6 inches square—non-directional	$10.00
Type A-7236 (175-1000 meters) 6 inches square—non-directional	12.00
Type B-2537 (300-700 meters) 18 inches square—directional	20.00
Type BL-2520 (200-18,000 meters) with honeycomb coil, 18 inches square—directional	25.00

Sold by the best dealers

V-DE-CO RADIO MFG. CO.
ASBURY PARK, N. J.
Dept. W

LEARN THE CODE

Get all the fun there is to to be had from your wireless set. Learn to read the dots and dashes and double your pleasure.

The Marconi-Victor Records
Provide the ideal instruction

SIX DOUBLE FACED RECORDS—TWELVE LESSONS

From the alphabet to press and code work. Actual operating conditions reproduced. Satisfaction guaranteed.

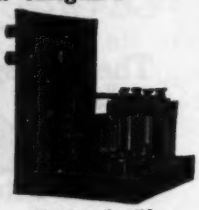
Price: $5.00 ***per set***

WIRELESS PRESS, Inc. **326 BROADWAY, NEW YORK**

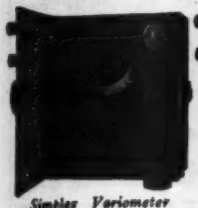
SIMPLEX

—that's your safeguard

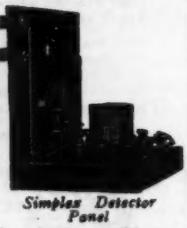
Simplex Vario-Coupler Panel



Simplex Amplifier Panel



Simplex Variometer Panel



Simplex Detector Panel

SIMPLEX PANEL UNITS make it possible to try out the many different hook-ups without disassembling panel, which is a decided advantage.

SIMPLEX RADIO CO.
1013-15 Ridge Ave. Phila., Pa.

BRACH
VACUUM RADIO PROTECTOR

Ask your insurance agent

Approved By National Board Fire Underwriters

$3

The Choice of the Foremost Engineers for Over 17 Years

SOLDERALL

The Only Convenient Metal Solder

Every Electrical Connection needs SOLDERALL for Perfect Reception

AT JOBBERS AND DEALERS OR BY MAIL
25¢ A TUBE

L.S. BRACH MFG. CO.
NEWARK, N. J.

Super-Sensitiveness!

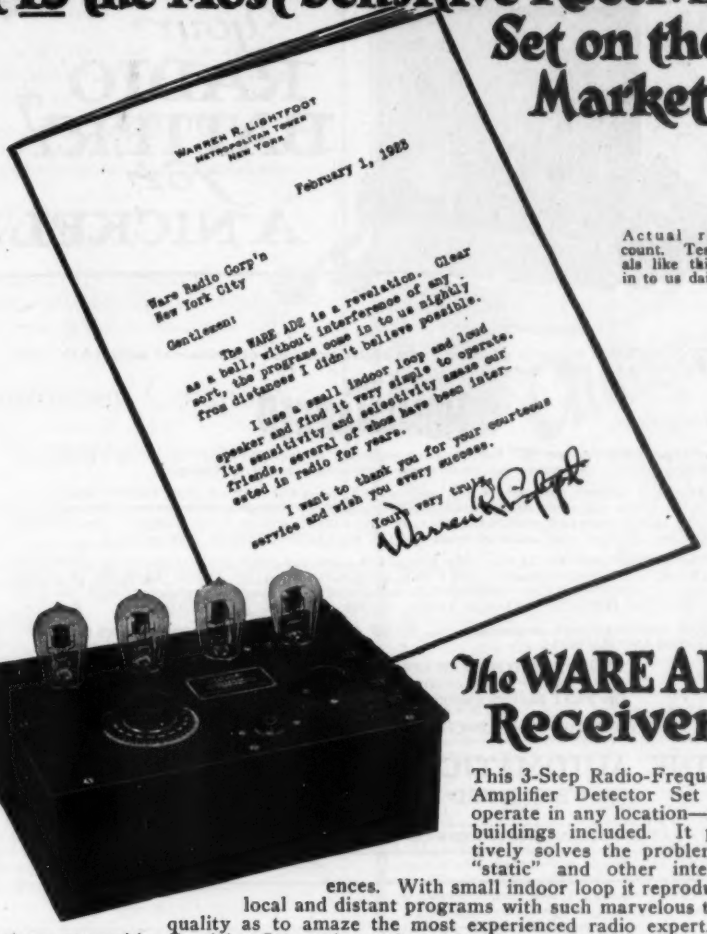
The crystal is the "bull's-eye" of your crystal receiving set. Unless it is super-sensitive you are wasting time and entertainment and cannot "hit" the combination for best results. Insist upon the genuine original Arlington tested "NAA" Detector minerals. They are carefully selected from bulk stock, individually tested and guaranteed super-sensitive. Galena, Goldfite or Silicon, price for crystal, 25c. Same mounted in brass cup, 40c. Obtainable at your dealer's or sent direct (postpaid) on receipt of price.

Newman-Stern Building Cleveland, Ohio

The Newman-Stern Co.

Ware

It IS the Most Sensitive Receiving Set on the Market



WARREN R. LIGHTFOOT
METROPOLITAN TOWER
NEW YORK

February 1, 1923

Ware Radio Corp'n
New York City

Gentlemen:

The WARE AD2 is a revelation. Clear as a bell, without interference of any sort, the programs come in to us slightly from distances I didn't believe possible.

I use a small indoor loop and loud speaker and find it very simple to operate. Its sensitivity and selectivity amaze our friends, several of whom have been interested in radio for years.

I want to thank you for your courteous service and wish you every success.

Yours very truly,
Warren R. Lightfoot

Actual results count. Testimonials like this pour in to us daily.

The WARE AD 2 Receiver

This 3-Step Radio-Frequency Amplifier Detector Set will operate in any location—steel buildings included. It positively solves the problem of "static" and other interferences. With small indoor loop it reproduces local and distant programs with such marvelous tone quality as to amaze the most experienced radio expert. It IS the most sensitive Receiving Set on the market and fully guaranteed.

Price—without Tubes—$110.

Order direct or send for descriptive pamphlet.
DISTRIBUTORS and DEALERS Write for proposition.

WARE RADIO CORP'N

160-162 DUANE ST. NEW YORK, N.Y.

Ware

Radio Operator's School

In selecting the school in which you wish to become a radio operator, bear in mind that this school has been in operation over twelve years, that all of our graduates are placed in positions, that our laboratory equipment is of the latest type, and that our instructors are expert professional radio men.

Y. M. C. A. RADIO SCHOOL

"The Best Radio School in the East"

149 East 86th St. TELEPHONE LENOX 6051 **New York, N. Y.**

HOMCHARGE Your RADIO BATTERY for A NICKEL

ENJOYABLE concerts and maximum receiving range are obtained only when your battery is fully charged.

THE HOMCHARGER

charges your "A" or "B" battery over night for a nickel without removing it from your living room. No muss—no trouble—no dirt—requires no watching.

After the concert connect to any lamp socket, snap the clips on your battery and "turn in." While you sleep the HOMCHARGER is silently charging your battery, the charging rate being governed automatically. In the morning it is fully charged. No OTHER battery charger can boast of such QUICK and ECONOMICAL performance.

The HOMCHARGER is the only battery charger combining all of these NECESSARY HOMCHARGING features: SELF-POLARIZING—FIVE TO EIGHT AMPERE charging rate—UNDERWRITERS' APPROVAL—beautifully finished in mahogany and old gold —UNQUALIFIEDLY GUARANTEED. OVER 90,000 NOW IN USE.

Sold complete with ammeter, etc., by all good radio and electrical dealers for $18.50 ($25.00 IN CANADA).

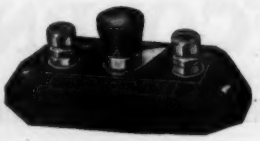
See the RADIO HOMCHARGER DE LUXE at your dealer's or write direct for our FREE circular showing why the HOMCHARGER is the BEST battery charger at any price.

MOTORISTS—The HOMCHARGER will also charge your AUTO battery.

THE AUTOMATIC ELECTRICAL DEVICES CO.
119 WEST THIRD STREET · CINCINNATI, OHIO

LARGEST MANUFACTURERS OF VIBRATING RECTIFIERS IN THE WORLD

Freshman Products—Accurate and Dependable



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Unbroken range—Zero to 5 Megohms—Clarifies signals, lowers filament current, increases battery life, eliminates hissing.

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.0005	.35
.001	.40
.002	.40
.0025	.50
.005	.75
.006	1.00
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Assure absolute noiselessness—clarity of tone—accuracy—constant fixed capacity.

.006 Micons and Variable Resistance Leaks, especially adapted for New Flewelling Super Circuit.

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The Missing Link in RADIO

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It is installed in a minute by changing only one connection and is indispensable on any receiving set, with any type of antenna. It is mounted on a Formica panel in a handsome mahogany finished cabinet 6x5x6.

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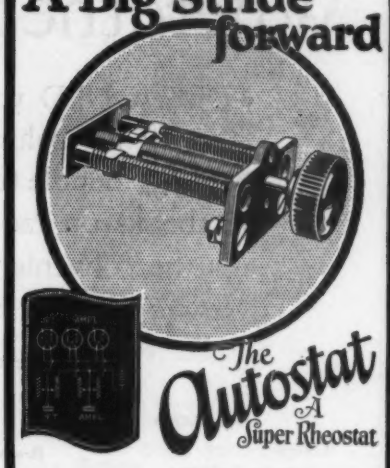
Canadian Distributor: The Jack V. Elliot Co., Hamilton, Ontario Canada

A Big Stride forward



The Autostat
A Super Rheostat

Can be used with 6-Volt or WD11 Detector Tubes, two Amplifying bulbs, or one 5-Watt Power Tube.

THE AUTOSTAT presents an entirely new principle in filament rheostat construction and radio takes another BIG step forward.

No longer is it necessary to turn a "hair's breadth" to tune in that elusive station, for with the AUTOSTAT you can give the knob a substantial turn and get a superfine adjustment. No other rheostat to date possesses the necessary "fineness" of adjustment to eliminate interference and "tube howls" under all conditions. But the AUTOSTAT, with its micrometer adjustment, will positively give these much-sought-for results.

How It Works

Two parallel mounted resistance tubes are connected in series by a "micrometer-operated" slider—the length of wire in circuit depending upon the location of this movable slider. Forty turns of the AUTOSTAT knob are required to complete the variation from minimum to maximum resistance — against one-half to three turns on others.

This exclusive patented construction means:

1. One full turn of AUTOSTAT knob produces finer tuning than a "hair's-breadth" turn on any other.
2. Economical — only two AUTOSTATS required for a three-bulb set.
3. Greatly increased receiving range and clearness of signals.
4. A uniform change in resistance with each turn of the AUTOSTAT knob.
5. Indestructible wire-wound fireproof lava resistance element.
6. Unqualifiedly guaranteed.

Popularly priced, ***$1.35***

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See your jobber or write direct for Radio's most attractive Rheostat proposition.

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Builders of Precision Rheostats Since 1914

Where the Best Radio Books Are Sold

WOULD you like to personally examine these books? The list below contains names and addresses of dealers who handle the famous Wireless Press series of laboratory-tested textbooks on radio. It is arranged geographically and published for the convenience of those who are located at a distance from New York and prefer to deal with a nearby or local dealer.

ALABAMA

Auburn
Burtons Bookstore

ARKANSAS

Hot Springs
Wyatt Book Store

CALIFORNIA

Altadena
Altadena Radio Laboratory, 90 North Los Robles Ave.

Berkeley
Sather Gate Book Shop 2307 Telegraph Ave.

Hollywood
Hollywood Bookstore, 6804 Hollywood Blvd.

Los Angeles
The Jones Book Store 619 South Hill St.
Stratford & Green, 642 South Main St.
Western Radio Electric Co., 637 South Hope St.

Pasadena
A. C. Vroman, 320 East Colorado St.

Sacramento
Weinstock Lubin Co.

Salinas
Salinas Storage & Battery & Elec. Co., 24 Cabilan St.

San Francisco
Holmes Book Store, 152 Kearney St.
Colin B. Kennedy, 209 Rialto Bldg.
Leo J. Meyberg, 428 Market St.

San José
Winch and Marshall, 80 South First St.

COLORADO

Denver
Denver Dry Goods Co.

Fort Collins
Evans Book Store, 147 South College Ave.

Pueblo
Main Auto Accessory Shop, 123 North Main Ave.

CONNECTICUT

Greenwich
Greenwich Electric Co., 262 Greenwich Ave.

Middletown
Hazens Book Store, 238 Main St.

New Haven
Crown Light & Supply Co., 111 Crown St.
New Haven Elec. Co., 296 Elm St.

DISTRICT OF COLUMBIA

Washington
Continental Elec. Supply Co., 808 Ninth St., N. W.
Pearlman's Book Shop, 931 "G" St., N. W.
White & Boyer, 812 13th St., N. W.

FLORIDA

Tampa
Pierce Electric Co.

GEORGIA

Atlanta
Cole Book Co., 123 Whitehall St.
Lester Book and Stat. Co., 70 North Broad St.
Miller's Book Store, 64 North Broad St.

ILLINOIS

Chicago
Central Elec. Co., 316-26 South Wells St.
Chicago Radio Apparatus, 508 South Dearborn St.
Commonwealth Edison Co., 72 West Adams St.
Montgomery, Ward & Co.,
A. C. McClurg & Co., 330 East Ohio St.
Paine Book Co., 75 West Van Buren St.
Popular Mechanics, 6 North Michigan Ave.
Radio Digest Pub. Co., 123 West Madison St.
C. V. Ritter, Van Buren and Dearborn Sts.
Sears Roebuck & Co.
Snyder Radio Co., 318 Walnut St.
Western Book and Stationery Co. 427 South Wabash Ave.
Woodworth's Book Store, 112 South Wabash Ave.

Peoria
Jacquin & Co.
Peoria News Stand, 500 Main St.

Wheaton
College Book Store

INDIANA

Crawfordsville
Schultz & Schultz, 123 East Main St.

Indianapolis
Hatfield Electric Co.
W. K. Stewart & Co.

South Bend
Book Shop, 119 North Nerehaga St.
South Bend Electric Co., Sample and Michigan Sts.

IOWA

Sioux City
The McGraw Co., 515 5th St.

KANSAS

Emporia
Eckdoll & McCarthy

Topeka
Topeka Electric Co., 816 Kansas Ave.
Zercher Book & Stat. Co.

Wichita
United Elec. Co.

KENTUCKY

Louisville
H. C. Tafel Co., 226 West Jefferson St.

LOUISIANA

New Orleans
S. Siler, 930 Canal St.

MAINE

Portland
Loring, Short and Harmon, 474 Congress St.

MARYLAND

Baltimore
W. E. C. Harrison & Sons, 224 East Baltimore St.
Hochchild, Kohn & Co., 147 West 54th St.
Norman Remington Co., Charles and Mulberry Sts.
J. M. Zamoiski, 19 North Liberty St.

MASSACHUSETTS

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DeWolfe, Fiske & Co., 20 Franklin St.
Charles E. Lauriat Co., 385 Washington St.
Old Corner Book Store, 27 Bloomfield St.
Pettingell-Andrews Co.
F. D. Pitts Co., 12 Park Square
Wetmore Savage Co.
Williams Book Store, 2 Milk St.

New Bedford
H. S. Hutchinson & Co., 222 Union St.

Springfield
H. R. Hunting Co., Inc., 29 Worthington St.
Whitall Electric Co.

MICHIGAN

Ann Arbor
Slater Book Shop, 334 South State.
George Wahr, 103 North Main St.

Battle Creek
E. C. Fisher & Co., 12 West Main St.

Detroit
Crowley, Milnor & Co.
Detroit Electric Co., 113 East Jefferson Ave.
W. J. Hartwig, 127 East Jefferson Ave.

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1268 Library Ave.

John V. Shechan & Co.,
262 Woodward Ave.

Grand Rapids

C. J. Litscher Elec. Co.,
41 Market St., S. W.

Sault Ste. Marie

Rudell Drug Co.,
301 Askumm St.

MINNESOTA

Minneapolis

Sterling Electric Co.,
31 Fifth St.

St. Paul

Northwest Elec. Equipment Co.,
174 East 6th St.

St. Paul Book & Sta. Co.

MISSOURI

Columbia

Missouri Store Co.

Kansas City

Central Radio Co.,
515 Grand Ave.

F. G. Cramer Bookstore,
1321 Grand Ave.

Western Radio Co.,
6 West 14th St.

Kirksville

College Book Store

St. Louis

Blackwell, Wielandy Book & Sta. Co.

Linze Electrical Supply Co.,
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Western Electric Co.,
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Butte

Keefe Brothers,
P. O. News Stand

Great Falls

McKee Stationery Co.,
315 Central Ave.

NEBRASKA

Norfolk

Huse Publishing Co.,
320 Norfolk Ave.

Omaha

Kiesser's Book Store,
221 North 10th St.,

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Savage Hardware & Supply Co., Inc.,
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Asbury Park

Van Dyke Electric Co.,
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Atlantic City

Traymore Bookshop,
1709 Boardwalk

Cranford

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Harrison

T. Shuver & Co.

Hamilton St. and Franklin Ave.

Newark

L. Bamberger & Co.

Galvin Radio Supply Co.,
66 Halsey St.

Krich Light Co.,
306 Market St.

Newark Elec. Supply Co.,
223 Market St.

Radio Distributing Co.,
8 West Park St.

Paterson

White's Book Store,
91 Van Houten St.

Princeton

The Princeton University Store

West Hoboken

Heraco Exchange, Inc.,
615 Bergenline Ave.

NEW YORK

Beacon

Lewis Electric Co.,
267 Main St.

Brooklyn

Abraham & Straus,
Fulton St.

F. Loeser & Co.,
Fulton St.

Buffalo

Queen City Book Co.,
43 Court St.

McCarthy Bros. & Ford,
75 West Mohawk St.

Federal Tel. & Tel. Co.,
1738 Elmwood Ave.

Otto Ulbrick Co.,
286 Main St.

Elmira

MacGrieney & Sleght-De Graff Co.

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354 Fourth Ave.

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32 Park Place

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5th Ave. and 27th St.

Continental Radio & Elec. Corp.,
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Gimbel Brothers,
33rd St. and 6th Ave.

David Killoch Co.,
57 Murray St.

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Stanley and Patterson,
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Syracuse

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Troy

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268 River St.

Utica

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Smith Novotoy Elec. Co.,
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Fayetteville

Hunter Bros. Electric Co.,
116 Hay St.

OHIO

Canton

Moock Elec. Supply Co.,
Cleveland Ave. at 5th St., N. W.

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Book Shelf,
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Cleveland

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Radioelectric Shop,
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Toledo

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321 Huron St.

Youngstown

Hood Electric Co.

OKLAHOMA

Oklahoma City

Parlette Wigger Co.,
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OREGON

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Hazelton

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1533 Pine St.

Sayre-Level Radio Co.,
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F. H. Stewart Elec. Co.,
37 North 7th St.

Pittsburgh

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Ludwig Hommel & Co.,
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Priscilla Gunther's Shop,
Union Arcade

Radio Electric Co.,
1427 Liberty Ave.

Robbins Electric Co.,
830 Liberty Ave.

Union Electric Co.,
933 Liberty St.

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Sharpsburg

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8th and Main Sts.

Wilkes-Barre

Foster Radio & Electric Co.,
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The Outlet Co.,
Weybosset, Eddy Garnet and Pine Sts.

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Columbus

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TENNESSEE

Memphis

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Lamar & Barton,
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J. D. Van Winkle Co.,
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Tyler

Byrne Publishing Co.

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Pullman

Students Book Co.

Seattle

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Wells Mfg. Co.

Madison

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Milwaukee

Julius Andrea & Sons Co.,
Broadway and Michigan Sts.

Kisselman & O'Driscoll,
Water, Wells and 2nd Sts.

New Era Book Shop,
211 Wills St.

AUSTRALIA

Sydney

Wireless Press,
97 Clarence St.

CANADA

Montreal

Scientific Experimenter, Ltd.,
St. Sacrament St.

Ontario

Thorburn and Abbott,
113 Sparks St., Ottawa.

Toronto

T. Eaton & Co., Ltd.

McAinsh & Co.,
412 College St.

Ryerson Press,
Qurre and John Sts.

CHINA

Shanghai

Mission Book Co.,
12 North Szechven Road

ENGLAND

London, W. C. 2

Wireless Press, Ltd.,
12-13 Henrietta St., Strand

HOLLAND

Amsterdam

Technische Boekhandel,
Nederlansch Persbureau Radio,
Kerzersgracht 562.

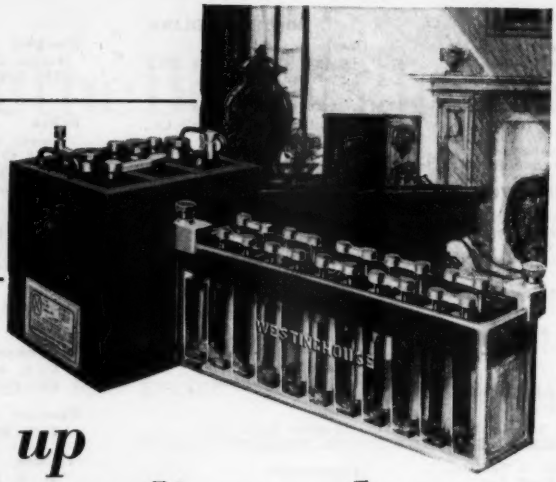
JAPAN

Tokyo

Maruzen & Co.,
11-16 Nihonbashli,
Toni Samheme.

HONOLULU, T. H.

Electric Shop,
Fort and Britiani Sts.



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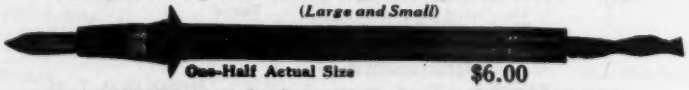

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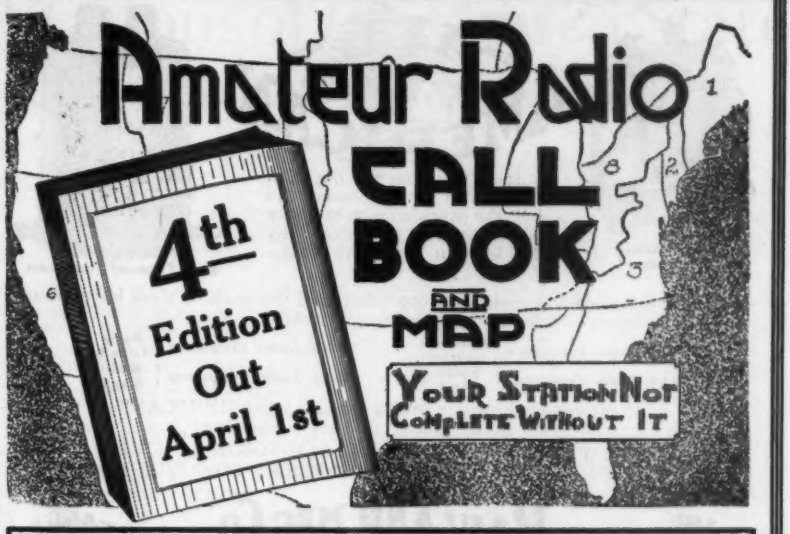

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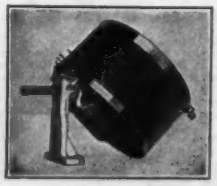

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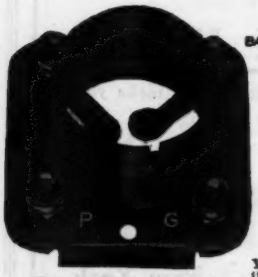

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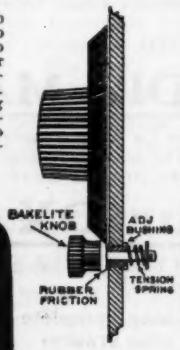

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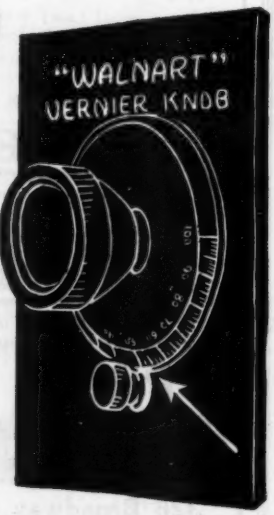

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Supplementary List brought up-to-date from March WIRELESS AGE

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1 AQL Grover C. Brown, 14 South St.....Eastport, Me.
1 AQM Clarence C. Margerum, 483 Pleasant St., Worcester, Mass.
1 AQO Thomas E. Marchant, Jr., 231 Poplar St., Roslindale, Mass.
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1 AQW Herman H. Hammer, 20 Salem St.....Lynn, Mass.
1 AQY William P. Libby, Jr., 259 Court St..Plymouth, Mass.
1 AQZ Herbert D. Breivogel, 15 Lunt St.....Quincy, Mass.
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1 ARN George F. Leal, 239 Beacon St.....Somerville, Mass.
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1 ARP Loomis Institute .....Windsor, Conn.
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1 ARV Kiernan Glennon, 55 Pearl St.....Stoughton, Mass.
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1 BQL Charles P. Howe, Mt. View Park, Cape Elizabeth, Me.
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1 GS Gerard J. Kohler, 16 Mosgrove Ave., Roslindale, Mass.

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1 CSK Capelle, Philip B., 590 Bergen Ave.Jersey City, N. J.
1 CSL Mayers, Bertrand F., 175 W. 72nd St., New York, N. Y.
1 CSM West, Clarence H., 1023 44th St.....Brooklyn, N. Y.
1 CSN Sheffield, David E., Murray Ave.....Ridgewood, N. J.
1 CSO Sadler, Alfred M., 30 Emory St..Jersey City, N. J.
1 CSP Arthur, Wm. Thiel, 438 Fulton St...Elizabeth, N. J.
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1 CSS Mains, Louis J., 103 N. 19th St., East Orange, N. J.
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1 CSV Columbo, Joseph, 2502 8th Ave.....New York, N. Y.
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1 CSW Wilson, Frank H., 121-18 Jerome Ave., Morris Park, N. Y.
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1 CUE Resurrection Radio Club, 240 E. 31st St., New York, N. Y.
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1 CUI Terwilliger, L. B.....R. D. 43, Tivoli, N. Y.
1 CUJ Gerstchner, Walter, 547 Lake Ave..Lyndhurst, N. J.
1 CUK Banks, Wilber C., 43 Monroe Pl., Bloomfield, N. J.
1 CUL Ingalls, Warren, Box 688, Route 2, White Plains, N. Y.
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1 CUN Fallender, Otto, Hanford Pl.....East Islip, N. Y.
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1 CUR Irwin, William C. K., 540 W. 136th St., New York, N. Y.
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2 CVC Williams, Aaron F., 316 1st St.....Scotia, N. Y.
2 CVD Fendt, Harry L., Jr., 200 Richmond Turnpike, Tompkinsville, N. Y.
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2 CVF Hasslinger, Ralph, 98 Highland Pl., Ridgefield Park, N. J.
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2 CVL Know, Walter, 317 E. 196th St....New York, N. Y.
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2 CWD Tompkins Radio Club, 37 North St., Middletown, N. Y.
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3 ABG Deutschman, Borah, 17 6th St.....Easton, Pa.
3 ABS Schwartz, Edward F., 605 Mattoax St., Petersburg, Va.
2 ABV Stahl, Carroll C., Bowers Ave.....Lemoyne, Pa.
3 ABZ Boericke, Edmund R., Price and Narbrook Sts., Narberth, Pa.
3 ACI Bostick, John, 2828 N. Memphis St., Philadelphia, Pa.
3 ACL Condon, Morris G., 308 W. Main St., Moorestown, N. J.
3 ACP Malsberger, Curtis E., 1746 Chew St., Allentown, Pa.
3 ADA Hicks, George E., 181 Spring St....Newton, N. J.
3 ADB Burrell, Edward S., 404 Gowen Ave., Mt. Airy, Philadelphia, Pa.
3 ADG Fisher, Robert L., 28 E. North Ave., Bethlehem, Pa.
3 ADH Jennings, James, 9 Hillairy Ave..Morristown, N. J.
3 ADM Dow, James N., 4914 Osage Ave...Philadelphia, Pa.
3 AED Evans, Courtney, 164 Oakland Ave., Audubon, N. J.
3 AEH Chalt, Harold, 12 S. Broad St....Penns Grove, N. J.
3 AEN Warner, Seymour Y., Jr., 120 Edgewood Rd., Ardmore, Pa.
3 AGV Donahue, John C., 1939 N. 23rd St., Philadelphia, Pa.
3 AQT Williams, H. Berwind, Second Ave.....Avalon, N. J.
3 AQY Stratton, Preston, 130 Walnut St..Bridgeton, N. J.
3 ARU Lang, Joseph F., 1918 N. Judson St., Philadelphia, Pa.
3 AVG Griffith, Warren, 5027 Osage Ave., Philadelphia, Pa.
3 BFI Knight, Frank, 4475 Green St., Germantown, Philadelphia, Pa.
3 BMC Creighton, Robert R., 237 Virginia Ave., Audubon, N. J.

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3 AFW McGonegal, A. R., 300 Clarendon Ave., Clarendon, Va.
3 AHZ Carns, George W., 1134 S. 54th St., West Philadelphia, Pa.
3 AIM Shaefer, LeRoy, 206 Brobst St.....Shillington, Pa.
3 AJW Upman, Edgar, 1921 W. Fayette St., Baltimore, Md.
3 ALJ Geiger, John C., 226 Noreg Pl., Brooklawn, N. J.
3 ALP Lacy, George B., 653 East Capitol St., Washington, D. C.
3 AOJ Best, Riddick H., A. C. L. Railroad, Dunlop Station, Va.
3 APX Flake, Wilson C., 125 Indiana St., N. W., Washington, D. C.
3 ARO Davis, James B., Jr., 700 "G" St., S. W., Washington, D. C.
3 ASQ Hedges, Lewis, 2010 14th St., N. W., Washington, D. C.
3 ATW Goldberg, Morris, 300 15th St., S. E., Washington, D. C.
3 BCW Burleson, Raymond C., 61st and East Capitol St., Washington, D. C.
3 BOD Fennell, George F., 553 E. Maryland St., Germantown, Philadelphia, Pa.
3 CBZ Ritchie, Joe, Stribling Ave.....Charlottesville, Va.
3 CDE Gelser, W. Don, 4630 N. 11th St., Philadelphia, Pa.
3 FA Atlee, Franklin, 2321 DeLancey St., Philadelphia, Pa.
3 OY Wilson, Victor E., 2861 Garnet St., Philadelphia, Pa.
3 PM Horn, Chas. S.....Renoboth Beach, Del.
3 ASR Bloom, Brace, 10 Prospect St., Morristown, N. J.
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4 AI Goings, Dolie, 510 S. Broad St.....Rome, Ga.
4 DI Krider, Ferdinand E., 260 Kelly St., Statesville, N. C.
4 GQ Beaton, Roy J., 461 Crew St.....Atlanta, Ga.
4 GR Acton, Harold T., 41 Virginia Circle, Atlanta, Ga.
4 IK Davis, Morison C., and Dale, Leon R., 148-50 Bellwood St., Atlanta, Ga.
4 KK Wingard, Carl F., 165 Kelly St.....Atlanta, Ga.
4 LE Pigford, Guy E., 505 Peachtree St.....Atlanta, Ga.

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5 ADX Fennell, George, 2132 Everett St.....Houston, Tex.
5 ADY Ratliseeau, W. L., Jr., 3812 Avenue P, Galveston, Tex.
5 ADZ Stewart, Leonard D.....Gorman, Tex.
5 AEA Mann, Horace H., 520 So. Park St., Sapulpa, Okla.
5 AEB Murphy, Samuel R., 516 N. E. Third St., Mineral Wells, Tex.
5 AEC Fish, Raymond L., 237 E. 33rd St., So., Oklahoma City, Okla.
5 AED Camp, Cason V., Jr., Eighth Ave.....Teague, Tex.
5 AEE Swan, Merrill L., 1512 W. 30th St., Oklahoma City, Okla.
5 AEF Luke, Robert S., 124 West Spring St., Weatherford, Tex.
5 AEG McCrary, R. Edward, R. F. D., care of W. O. McCrary, Spur, Tex.
5 AEH Smith, Frank H., 227 N. Locust St., Fayetteville, Ark.
5 AEI Donnelly, Harry M., 215 James Ave., Goose Creek, Tex.
5 AEJ Allison Motors, Fred M., 632 N. Beaton St., Corsicana, Tex.
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5 AEM Wallis, Dean H., 2336 Burdette St., New Orleans, La.
5 AEN Wood, Charles W., 103 Valette St., New Orleans, La.
5 AEO Rieben, Harry, 1101 Delaware St., Memphis, Tenn.
5 AEP Garcia, Miguel F., 818 Elizabeth St., Brownsville, Tex.
5 AEQ Bellinghausen, W. A., Jr., Box 360, Brownsville, Tex.
5 AER Fricke, Julius S., 411 State St.....Texarkana, Tex.
5 AES Hoagland, Max C., care of N. Mex. Military Academy, Roswell, N. M.
5 AET McDuffie, Willard .....Forney, Tex.
5 AEU Epps, Clyde W.....Forney, Tex.
5 AEV Eversole, Harvey W.....Rock Island, Tex.
5 AEW Chron, Robert E., Jr., 1019 N. Salado St., San Antonio, Tex.
5 AEX Jones, Apurgeon A.....Crafford, Tex.
5 AEY Eubank, B. C.....San Benito, Tex.
5 AEZ Bright, Miles A., 1604 Louisiana St., Little Rock, Ark.
5 AFA Menees, Winfred.....Quitman, Ark.
5 AFB James, Cecil B.....Hamilton, Tex.
5 AFC Balcom, George S., 1412 Avenue C, Beaumont, Tex.
5 AFD Sexton, Robert, 112 Washington St., Brownsville, Tex.
5 AFE Wheeler Radio Co., 411 Duncan St....Conway, Ark.
5 AFF Walters, Martin T., 902 Carey Pl., Chattanooga, Tenn.
5 AFG Challenger, Ansel, 530 W. 20th St., Oklahoma City, Okla.
5 AFI Daniels, Roy E.....San Benito, Tex.
5 AFJ Holland, C. F., 1704 Houston Ave., Port Arthur, Tex.
5 AFK Eddy, David W.....Lake Charles, La.
5 AFL Estes, David L., 2244 West Park St., Oklahoma City, Okla.
5 AFM Ekdale, A. E., 115 N. Chester St. (Portable Station), Pasadena, Calif.
5 AFN Adkins, W. S., 156 Austin St....San Benito, Tex.
5 AFO Shepherd, G. J., 1309 State St....Little Rock, Ark.
5 AFP Green, R. F., W. Brownsville St., Brownsville, Tex.
5 AFQ Smith, J. P., Jr., 320 Washington Ave., Fayetteville, Ark.
5 AFR Harris, W. C., Jr., Step 6, Dallas Pike, Fort Worth, Tex.
5 AFS Hughes, E. C., Jr., 1060 Selma St....Mobile, Ala.
5 AFT Burton, R.....Roanoke, Ala.
5 AFU Ford, F. A., 20th and Townsend Sts., Ada, Okla.

5 AFV Barry, W. E., 6626 H St.....Houston, Tex.
5 AFW Jordan, R. L., 6742 Avenue J.....Houston, Tex.
5 AFX Staley, M. E., 216 E. Huisache Ave., San Antonio, Tex.
5 AFY Hanson, Lubie H., 201 E. James St., Goose Creek, Tex.
5 AFZ Snyder, George P.....Glenrose, Tex.
5 AGA McDavid, R. & P., 611 Robin St....Houston, Tex.
5 AGB Craig, Parley W., 206 Avenue F.....Ensley, Ala.
5 AGC Thomas, John F., 701 Arlington St....Lawton, Okla.
5 AGD Lynch, Thomas S., 360 Washington Ave., Mobile, Ala.
5 AGE Knapp, Shirley B., 2101 Hazel St., Texarkana, Tex.
5 AGF Kristek, Albert L.....Flatonia, Tex.
5 AGG Wooten, S. D., Jr.....Coldwater, Miss.
5 AGH Adams, Garner, 203 Featherstone St., Cleburne, Tex.
5 AGI Tell, Wm. K., 600 Avenue D.....Eagle Pass, Tex.
5 AGJ Prince, Edmond M., 601 Highland Park, Birmingham, Ala.
5 AGK Hetherington, John F., 104 Main St., Stillwater, Okla.
5 AGL Huepers, August E., 3707 Avenue O, Galveston, Tex.
5 AGM Herndon, Andrew A., Belvieue, Moss Point, Tex.
5 AGN Ellis, Walter L., 625 E. Sixth St., Oklahoma City, Okla.

Eighth District

8 FH Vincent J. Lapp, 32 Church St.....LeRoy, N. Y.
8 GL Franklin High School, Otter St.....Franklin, Pa.
8 GZ L. G. Windom, 1375 Franklin Ave., Columbus, Ohio
8 LC G. Robert Burns, 71 Hancock Ave., E. Detroit, Mich.
8 OK Chas. A. Plunkett, Jr.....Lewisburg, W. Va.
8 PP Herbert Hayes, 3017 W. 46th St., Cleveland, Ohio
8 SM Clarence Gielow, 218 McDonough St., Sandusky, Ohio
8 VT William T. Nelson, North Main St., Royal Oak, Mich.
8 AAJ Howard H. Brokate, 217 Washington St., Port Clinton, Ohio
8 ASS Raymond L. Chambordon.....Braeburn, Pa.
8 ASX George Powell, Lillilson St.....Romeo, Mich.
8 BAV Leland H. Krompart, 215 Williams St., Medina, N. Y.
8 BCU Ira Runnels, 323 Griggs St.....Rochester, Mich.
8 BJN Franklin High School, 14 West Park St., Franklin, Pa.
8 BPA Charles M. Jacobs, 433 Circular St.....Tiffin, Ohio
8 BQF Edward V. Edwards, 410 St. John St., Schuylkill Haven, Pa.
8 BQI Clar Emerson Foltz, 610 South St.....Findlay, Ohio
8 BQS Edward S. Clark, 333 Princeton Pl., Pittsburgh, Pa.
8 BRR J. Lloyd Lents.....Rush Township, Ohio
8 BRS Alwin French, 1225 S. Milwaukee St., Jackson, Mich.
8 BRU Howard K. West, 429 Main Rd. R. F. D., Conneaut, Ohio
8 BSZ Kenneth S. Walborn, 371 Jackson Ave., Bradford, Pa.
8 BTM Charles M. O'Hara, 1605 6th Ave., McKeesport, Pa.
8 BUL Lynn Cooper, 641 W. Main St., Battle Creek, Mich.
8 BUP Henry White, 157 East Main St., Fredonia, N. Y.
8 BVB Herbert A. Hilier, 159 Hanover St., Silver Creek, N. Y.
8 BVC Walter Weber Conn, 516 Race St.....Dover, Ohio
8 BVW Unger's Drug Store, 328 W. Arch St., Shamokin, Pa.
8 BVX Mike Penyack, Madison St.....Herminie, Pa.
8 BVY George D. Covell, 162 Massachusetts St., Detroit, Mich.
8 BWC Edward C. Dailey, R. F. D. No. 2, Box 12, West Newton, Pa.
8 BXO Paul Marco, 688 Lawrence Ave.....Detroit, Mich.
8 BYC Alfred W. Johnson, Seneca St., Baldwinsville, N. Y.
8 BYE Roy Wm. Ewers.....South Haven, Mich.
8 BYL Brainard D. Norris, 104 Beverly Rd., Syracuse, N. Y.
8 BZC Raymond C. Hitenhue, Argonne Drive, Parnassus, Pa.
8 BZF Edward W. Stone, 395 E. Main St., Fredonia, N. Y.
8 CAE Burdette M. Baldwin, East Main St., Deshler, Ohio
8 CAF William Rowe Atwater, 463 E. 123rd St., Cleveland, Ohio
8 CAI Gerald Davis, 415 Boyd St.....Van Wert, Ohio
8 CBB Alexander J. Moore, 1403 Orr Ave., Kittanning, Pa.
8 CBH William I. MacCurdy, 605 Glenwood Ave., Johnstown, Pa.
8 CCH Herbert Griffiths, 522 E. Martin St., East Palestine, Ohio
8 CFR Edward L. Pratt, 7 High St.....Cobleskill, N. Y.
8 CGG Connellsville Public Schools, E. Fairview Ave., Connellsville, Pa.
8 CGN Robert E. Galloway, 71 Oliver St., Pontiac, Mich.
8 CGS Chas. J. Harrison, Jr., 738 W. Church St., Elmira, N. Y.
8 CIX Arthur H. Slack, 108 Shinkle St.....Findlay, Ohio
8 CKY Harry C. Guier, 455 N. Washington St., Wilkes-Barre, Pa.
5 CLV A. Joel Bussard, 806 Center St., Wilkinsburg, Pa.
8 SLZ Charles H. Ellis, 292 Jewett St.....Buffalo, N. Y.
8 SMK King McCain, 1107 Harvard Blvd.....Dayton, Ohio
8 CMQ Harold A. Jaehn, 4440 Helen Ave....Detroit, Mich.
8 CMV Jared Warner Stark, 1465 Chicago Blvd., Detroit, Mich.
8 CNP Harry A. Dunn, W. Diamond Ave., Hazelton, Pa.
8 CNY Henry F. Lewis, 19 South West St., Shenandoah, Pa.
8 COH Charles A. Christopher, 524 Cross St., Rochester, N. Y.
8 COW Jesse O. Ellison, 80 W. High St....Detroit, Mich.
8 CPW Frederick L. Reynolds, 337 Castle St., Geneva, N. Y.
8 CPZ George Mueller, 733 Penn Ave.....Midland, Pa.
8 CRP Sigmund Wojnowski, 1344 Dewey Ave., Rochester, N. Y.
8 CSK John B. Eccles, 2435 Auburn Ave.....Toledo, Ohio
8 CTS Walter E. Kinney, S. Main St.....Marion, Ohio
8 CTY Beverly B. Bond, 8 Pleasant St.....Potsdam, N. Y.
8 CUD George Brown, 528 Cobb St.....Toledo, Ohio
8 CWK F. Kelvin Kearney, 3837 Warren Ave., W., Detroit, Mich.
8 CWU DeVaine Swigart, 904 Kenmore Blvd., Kenmore, Ohio
8 CYF Robert P. Irvine, 3444 Storer Ave., Cleveland, Ohio
8 CYI Joseph Hertzberg, 306 Clay Ave., Rochester, N. Y.
8 CZE Carlton Springett, 12 Clinton St....Fairport, N. Y.
8 CZG Alfred J. Seeley, 314 Locust St., Williamsport, Pa.
8 DBA Fred B. Hamilton, 9 Ridge Ave., Youngstown, Ohio
8 DBB George E. Quemacy, 6 Depot St., West Springfield, Pa.
8 DBC Frank M. Park, 715 Catalpa St.....Lima, Ohio
8 DBD Keith H. Lewis, Ridge Rd.....Middleport, N. Y.
8 DBE Ardell Crowe, 318 Jackson St.....Vandergrift, Pa.
8 DBF George F. Martin, Jr., 475 Ella St., Wilkinsburg, Pa.
8 DBG Byron R. Wedemann, 205 E. Market St., Scranton, Pa.
8 DBH Clair D. Foster, R. F. D. No. 2...Lakeview, Mich.
8 DBI E. E. Seymour.....Kelley Island, Ohio
8 DBJ Arthur L. Puffer.....West Springfield, Pa.
8 DBK Paul Hansen, 1802 Sanderson Ave., Scranton, Pa.
8 DBL Clyde W. Donner, 429 Main St.....Berlin, Pa.
8 DBM Samuel E. Taggart, 446 N. Buckeye St., Wooster, Ohio
8 DBN Jerome W. Eckenrode, 117 Park Ave., Wilkes-Barre, Pa.
8 DBO George B. Beiswanger, 622 N. Locust St., Adrian, Mich.
8 DBP Clare E. Crites.....Tuscarawas, Ohio
8 DBQ Lex M. Depp, 333 Oakland Ave., Pittsburgh, Pa.
8 DBR Donald M. Ryan, 1005 Steuben St., Utica, N. Y.
8 DBS Bernard Isbitsky, 107 Page St.....Kingston, Pa.
8 DBT Robert E. Gockdard, 41 Prospect St., Ashtabula, Ohio
8 DBU Roland P. Dinkel, 716 N. Charles St., Lima, Ohio
8 DBV Fred B. Maynard, 443 Franklin St., Palmerton, Pa.
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8 DBX Paul Renton, 203 Washington St., Vandergrift, Pa.
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8 DCA Walter L. Horn, 3952 Howley Ave., Pittsburgh, Pa.
8 DCB Frank Trauscht, 812 Putnam St....Findlay, Ohio
8 DCC Wilbur J. Gamblin, 104 E. Main St., Buckhannon, W. Va.
8 DCD Leon Shoff, 527 W. Jefferson St., Grand Lodge, Mich.
8 DCE Adrien C. Lugibihl, N. High St., Columbus Grove, Ohio
8 DCF Vincent M. French, 31 Kingsville Ave., Ashtabula, Ohio
8 DCG James D. Brewer, 434 N. Main St.....Ada, Ohio
8 DCH E. L. Baumann, 5 Parkman St.....Warren, Ohio
8 DCI Paul L. Derr, 236 W. Main St.....Ravenna, Ohio
8 DCJ Russel W. Neal, 411 High St.....Conneaut, Ohio
8 DCK Andrew C. Gerren.....Frankfort, Pa.
8 DCL Rea J. Thompson, 229 S. College St., Washington, Pa.
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8 DCN Arthur Kenneth Hoose, 135 Grant St., Painesville, Ohio
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8 DCQ Charles Grace, Woodland Ave.....Conneaut, Ohio
8 DCR Norman L. Chase, 107 Burt St.....Syracuse, N. Y.
8 DCS Paul Crouch, 198 Granville St.....Newark, Ohio
8 DCT Harley D. Hariss, 447 River St., Manistee, Mich.
8 DCU Henry G. Honta, 20 Shoemaker St., Forty Fort, Pa.
8 DCV John Haluska, 126 S. Morris St.. St. Clair, Pa.
8 DCW William W. Simpson.....Saranac, Mich.
8 DCX Marix Vanderveken, 2206 Washington Ave., Scranton, Pa.
8 DCY Kalamazoo High School, Vine St., Kalamazoo, Mich.
8 DCZ Howard Johnson, 209½ S. Main St., Upper Sandusky, Ohio
8 DDA Leon N. Howe, 9 Judson St.....Canton, N. Y.
8 DDB William J. Reilly, 3274 E. Yorkshire St., Cleveland Heights, Ohio
8 DDC John E. Wile, 564 N. Grant St.....Wooster, Ohio
8 DDD Deliet T. Poling.....Philippi, W. Va.
8 DDE Charles B. Havens, 82 Jefferson St., Columbus, Ohio
8 DDF Wilson W. Kohll, 351 Monroe St.....Tiffin, Ohio
8 DDG W. Charles Hovey, 30 Henrietta St., Amsterdam, N. Y.
8 DDH Earl B. Reithmiller, 434 Stewart Ave., Jackson, Mich.
8 DDI Herbert R. Hefferman.....Sherwood, N. Y.
8 DDJ Mark H. Tanner, 557 Second St., Gallipolis, Ohio
8 DDK Fred W. Brice, 119 East Pine St., Washington, Pa.
8 DDL Joseph McKay, 74 Webster St., No. Tonawanda, N. Y.
8 DDM Charles Kelly.....Kirkland, N. Y.
8 DDN Forrest M. Kimble.....Davis, W. Va.
8 DDO Carl M. Kneisel, 908 4th St.....Fairmont, W. Va.
8 DDP Lowell T. Hyer, Howard St.....Sabina, Ohio
8 DDQ Norwalk High School (Weldon Sanger), E. Main St., Norwalk, Ohio
8 DDR Ralph Harris, 601 W. Jefferson Ave., Grand Lodge, Mich.
8 DDS Harold E. Seamans.....Marathon, N. Y.
8 DDT David S. Madill, 413 Indiana Ave., South Haven, Mich.
8 DDU Walter O. Parmington, 376 Garson Ave., Rochester, N. Y.
8 DDV Roger G. Fahringer, 502 Center Ave., Clark's Summit, Pa.
8 DDW Edward L. Long, 34 Burgoyne St., Schuylerville, N. Y.
8 DDX Walter S. King, 419 W. College St., Canonsburg, Pa.

REASSIGNED CALLS.

8 JD Anthony A. Kiedis, Jr., 1031 Hamilton Ave., Grand Rapids, Mich.
8 MI Harold Roess, 421 Elia St.....Wilkinsburg, Pa.
8 NJ Hamilton A. Haywood, 607 Grant St., Buffalo, N. Y.
8 PS Harold C. Reiss, 9506 Columbia Ave., Cleveland, Ohio
8 TI Albert R. Heyden, 1810 Francis St., Jackson, Mich.
8 TK Amos and Mark Bickhard, N. Main St., Antwerp, Ohio
8 VD Raymond L. Chambordon.....Braeburn, Pa.
8 ACA Ivan W. Briggs, 57 North St....McGraw, N. Y.
8 APT Donald McGeorge, 2500 Derbyshire St., Cleveland Heights, Ohio
8 AKN Henry S. Bixby.....Dayton, N. Y.
8 ALC Loyal A. Lang, 1201 Walnut St., Turtle Creek, Pa.
8 APF Arthur J. Macer, 32 Bank St....Lyndhurst, N. Y.
8 AQB Eugene W. Wesselman, 2621 Reading Rd., Cincinnati, Ohio
8 ARQ Richard Dando, 35 W. Miami Blvd., Dayton, Ohio
8 BBZ Lawrence McDowell, 1838 N. Bend Rd., Cincinnati, Ohio
8 BJP Harold Wilke, 4464 Humboldt Ave., Detroit, Mich.
8 BKT Charles Hedrich, 46 Main St., Tonawanda, N. Y.
8 BRY Frederick D. Gamble, 946 Islington St., Toledo, Ohio
8 CAG Henry Henrichsen, 2892 E. 115th St., Cleveland, Ohio
8 CBA Frederick C. Thorold, 1503 N. Park Blvd., Flint, Mich.
8 CKB Donald Lefeber, 305 Ford St., Ogdensburg, N. Y.
8 CMP Eugene C. Woodruff, 234 W. Fairmount St., State College, Pa.
8 CMT Gordon Shook, 38 Fort St.....Forty Fort, Pa.
8 CYM Chester M. Bell, 241 Tremont St., N. Tonawanda, N. Y.
8 CZQ Earl L. Yates, 21 Parsons St., Binghamton, N. Y.
8 DAM Miles S. Specht, 141 W. Liberty St., Wooster, Ohio

Ninth District

9 EHV Samuel L. Ecker.....Sedan, Kans.
9 EHW Archie M. Crosier.....Weeping Water, Nebr.
9 EHX Jewell R. Benson, 618 W. Fourth St..Topeka, Kans.
9 EHY Lawrence A. Stineman, 428 W. 72d St..Chicago, Ill.
9 EHZ Edward C. Crossett, 936 Lake Shore Drive, Chicago, Ill.
9 EIA Elmer Holehouse, 472 North Ave..Wauwatosa, Wisc.
9 EIB Robert L. Stewart, 214 S. Glenwood St..Peoria, Ill.
9 EIC H. L. Perrine.....McCune, Kans.
9 EID Louis R. Hull, 3107 Broadway....Ft. Wayne, Ind.
9 EIE John Henry Wood.....Walhalla, N. Dak.
9 EIF George Gasper, 948 W. 27th St..Indianapolis, Ind.
9 EIG Wayne G. Eaton, 107 S. 4th Ave....Brighton, Colo.
9 EIH Eugene Hodson, 361 Fourth Ave..Milwaukee, Wisc.
9 EII George W. Pilgram, 2005 S. 15th St..St. Joseph, Mo.
9 EIJ John H. Miner, 858 N. Columbia St..Frankfort, Ind.
9 EIK Idean H. Paulson.....Sharon, N. Dak.
9 EIL Clyde S. Van Gordon, 7th and Harmony Sts., Osseo, Wisc.
9 EIM Edson Travis, 1208 N. Evans St....Bloomington, Ill.
9 EIN John F. Martin, 2350 S. Lawndale Ave., Chicago, Ill.
9 EIO A. Howard Case, 805 N. Main St..Charles City, Iowa
9 EIP Earl R. Murray, 851 W. Green St....Decatur, Ill.
9 EIQ Charles W. Newhall, Jr., Shattuck School, Faribault, Minn.
9 EIR Laurence Imel.....Malvern, Iowa
9 EIS Westinghouse Elec. & Mfg. Co., 717 S. Twelfth St., St. Louis, Mo.
9 EIT Tom S. Nichols, 607 Gilman St.....Moberly, Mo.
9 EIU Birely Whaley, 123 Conrey St....Shelbyville, Ind.
9 EIV Paul A. Robblee, 5145 Lyndale Ave., S., Minneapolis, Minn.
9 EIW Charlie Miller.....Minneapolis, Minn.
9 EIX Charles E. Slater, 1604 Fourth St....Nome, Iowa
9 EIY Judson Anderson, 3629 Blaisdell Ave., Minneapolis, Minn.
9 EIZ Marion W. Smith, 5621 Waterman Ave., St. Louis, Mo.
9 EJA Albert W. Strohmeyer, 1128 Bacon St., Indianapolis, Ind.
9 EJB John B. Young, 411 S. State St..Yates Center, Kans.
9 EJC Harold A. Jackson, 307 N. Prairie St., Yates Center, Kans.
9 EJD Stanley Lersch, 5063 W. 30th Place.....Cicero, Ill.
9 EJE Michael Strutzel.....Delmar, Iowa
9 EJF Wayne E. Granger, 1022 12th St.....Golden, Colo.
9 EJG Bertram R. Shilts, No. 3d St.....Tecumseh, Nebr.
9 EJH Hubert Williams, 341 Bowen St.....Savanna, Ill.
9 EJI Robert Stark, 3921 Boulevard Place, Indianapolis, Ind.
9 EJJ Mutual Telephone Co.....Traer, Iowa
9 EJK Melville A. Metz, 602 W. 15th St..Davenport, Iowa
9 EJL John W. Appleton, 3440 Elliott Ave....Berwyn, Ill.
9 EJM Richard F. Handlos.....Canteria, Wisc.
9 EJN Harold C. Heikes.....Minneapolis, Minn.
9 EJO Clyde C. Young, 3911 W. 8th St.....Duluth, Minn.
9 EJP Harry C. Kaupa.....Francesville, Ind.
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9 EJT Harry Caskey, 618 Brotherton St.....Muncie, Ind.
9 EJU Donald A. Burton, 2224 Jefferson St., Muncie, Ind.
9 EJV Robert C. Gore, 26 Madison Ave....Evansville, Ind.
9 EJW Joseph C. Hromada, 1320 Clinton Ave., Oak Park, Ill.
9 EJX Laurence H. Norton, 7030 34th St.....Berwyn, Ill.
9 EJY Leonard Tulauskas, 9323 Rhodes Ave...Chicago, Ill.
9 EJZ Stanley A. Vye, 3734 Pleasant Ave., Minneapolis, Minn.
9 EKA Raymond F. Wilmert, R. R. No. 4....Lincoln, Ill.
9 EKB Merrill Shum, 415 W. Main St.....Clarinda, Iowa
9 EKC Robert C. Pote, 4925 Park View Place, St. Louis, Mo.
9 EKD Harold W. Bets, 106 N. Fair St....Champaign, Ill.
9 EKE William Davis, Jr., 231 Stanley Ave., Cañon City, Colo.
9 EKF Loren W. Wood, 5522 Waterman Ave., St. Louis, Mo.
9 EKG Jack E. Wheeler, 1102 Mathewson St., Wichita, Kans.
9 EKH Danforth Barney, 1645 E. 7th Ave....Denver, Colo.
9 EKI Leon B. Shettle, R. F. D. No. 4, Correctionville Rd., Sioux City, Iowa
9 EKJ George E. Ganss, 5323 Minerva St....St. Louis, Mo.
9 EKK Walter Schormann.....Staplehurst, Nebr.
9 EKL Charles M. Lindsay.....Altamont, Mo.
9 EKM Joseph Hovorka, 1409 Wisconsin Ave..Oak Park, Ill.
9 EKN Darrell D. Gretorex, 125 E. Second St., Blue Earth, Minn.
9 EKO Clifford Caldwell, Box 15.....McClure, Ill.
9 EKP Harry S. Scott, 501 N. Wade St.....Marion, Mo.
9 EKQ Gordon G. Gladson, 329 W. 6th St..Chanute, Kans.
9 EKR Max F. Joern.....Nicollet, Minn.
9 EKS Paul C. Hanger, 3829 Paseo St....Kansas City, Mo.
9 EKT Lyndon J. Osterbolm, 2585 Pratt St....Omaha, Nebr.
9 EKU Floyd E. Moffet, Third St....Devils Lake, N. Dak.
9 EKV Ellis L. Miller, R. F. D. No. 3.....Mendota, Ill.
9 EKW Merlin O. Reese.....Melbourne, Iowa
9 EKX Garland S. Dutton, 204 E. 15th St., University Place, Nebr.
9 EKY Richard K. Rohan, 5809 DeGwerville Ave., St. Louis, Mo.
9 EKZ Archie P. Fenner, 13th and "P" Sts., Lincoln, Nebr.

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9 AC John A. Brennan, 5714 W. Race Ave...Chicago, Ill.
9 BL Robert F. Laidlaw, 6110 S. Maplewood Ave., Chicago, Ill.
9 KW Schiller Kruse, 1538 Kentucky St...Lawrence, Kans.
9 ABG W. J. Beetham.....Fennimore, Wisc.
9 ADJ Delwin V. Bergstrom, 707 Apple St.....Normal, Ill.
9 ADU Henry A. Anderson.....Pelican Rapids, Minn.
9 AET Paul Theisen, 6950 Western Ave.....Chicago, Ill.
9 ANV Alson E. Braley.....Wesley, Iowa
9 APT Franklin G. Ault, 525 Murray St....Hammond, Ind.
9 AQU David B. Gearhart, Box 216.....Hopkinton, Iowa
9 AUF Walter Wiegand, 717 N. Hamlin Ave...Chicago, Ill.
9 AUO Francis M. Quinn, 2244 Winona St....Chicago, Ill.
9 AUQ Albert S. Braaten, Concordia College, Moorhead, Minn.
9 AVQ Francis A. Heckendor, 2038 Gaylord St., Denver, Colo.
9 AWK Charles E. Erbstein, R. F. D. No. 6, Box 75, Elgin, Ill.
9 AWQ George L. Eldred, 714 6th St.....Carrollton, Ill.
9 AXD Louis E. Seevers, Jr., 126 North 4th St., Clinton, Iowa
9 AXX Russell Callender, 1669 Princeton Ave., St. Paul, Minn.
9 BMW Frederick L. Palmer, 204 S. 9th St., Independence, Kans.
9 CWJ Tevis R. Becker, 1176 Gaylord St....Denver, Colo.
9 DBF Elmer H. Conklin, 883 Cornelia Ave....Chicago, Ill.
9 DVJ Martin E. Ford, 6010a Suburban Ave., St. Louis, Mo.

CHANGES

9 BMR Florentine Rettig, 316 N. 9th St..Breckenridge, Minn.
9 CIC Clifton M. Fischbach, 222 S. Poplar St..Seymour, Ind.
9 BJY Charles G. Wagner, 901 N. Mulberry St., Chicago, Ill.
9 BKG Earl W. Lewis, 417 E. Carpenter St., Moberly, Mo.
9 BQO Clarence R. Shenberger, 123 S. State St., Marengo, Ill.
9 BSL Stanley H. Burke, 5727 S. Sawyer Ave., Chicago, Ill.
9 BLZ Albin H. Carlson, 1220 S. 23d St., Ft. Dodge, Iowa
9 BIZ Howard Powers, 309 S. Pleasant St...Princeton, Ill.
9 ADZ Raymond O. Gilbert, 5 Springs Blk., Grand Forks, N. Dak.
9 AFB Robert D. Stewart.....Cambridge, Wisc.
9 AVA Griffith M. Morgan, 845 S. Scoville St., Oak Park, Ill.
9 AVP Willard McCulla, 438 N. Sheridan Rd., Waukegan, Ill.
9 CII Charles F. Quentin, 820 Minnesota Ave., S. Milwaukee, Wisc.
9 CPE Harold A. Wells, 2147 Hazel St...Indianapolis, Ind.
9 DGI William M. Sharpless, 4512 Harriet Ave., Minneapolis, Minn.
9 EDD Orin S. Parker, 4700 N. Campbell Ave...Chicago, Ill.
9 OF Charles A. Krapf, 718 Myrtle St....Waukegan, Ill.
9 RE Wilber E. Monigan, 1818 Oliver St...South Bend, Ind.
9 KP A. G. Leonard, Jr., 4801 Woodlawn Ave., Chicago, Ill.

EXPERIMENTAL

9 XAR Omaha Central High School, 20th and Dodge Sts., Omaha, Nebr.

TECHNICAL AND TRAINING

9 YAP St. Ambrose College, 600 W. Locust St., Davenport, Iowa
9 YAS Coe College, 1st Ave. and 12th St., Cedar Rapids, Iowa
9 YAT St. Mary's High School.....Rushville, Nebr.

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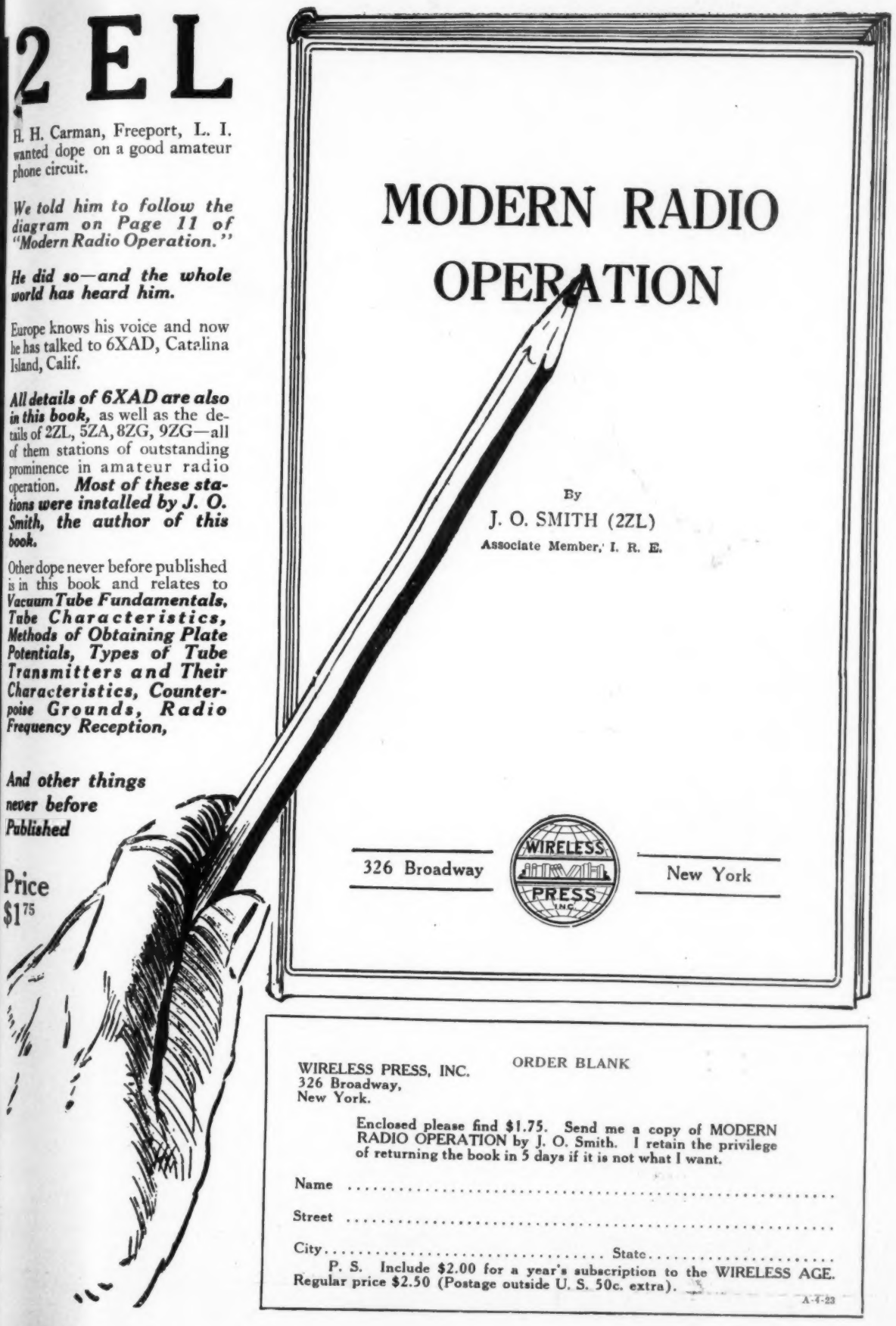

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